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LITERARY AND PHILOSOPHICAL SOCIETY

OF

LIVERPOOL,

DURING THE

SEVENTY-FOURTH SESSION, 1884-85.

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CORRECTED TO SEPTEMBER, 1885.

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March 24, 1879 Alexander, William, M.D., 102, *Bedford-street South.*

Nov. 1, 1880 Allen, Francis B., 100, *Newsham Drive, Newsham Park.*

Nov. 12, 1877 Allman, G. W., 4, *Ullet road, Prince's Park.*

March 7, 1864 Archer, F., B.A., Trin. Col., Cantab., 14, *Cook-street*, and *Boundary Cottage, Little Crosby.*

Nov. 29, 1880 Armour, Rev. S. C., M.A., Merchant Taylors' School, *Crosby.*

Nov. 13, 1876 Ball, Geo. Hy., 57, *Hope-street.*

April 20, 1874 Barton, Rev. John, M,A., *Vicarage, Rainhill.*

Nov. 15, 1869 Beer, Joseph B. de, *Northern Assurance-chambers, Tithebarn-street.*

Feb. 22, 1875 Bellew, Thomas A., 23, *Canning-street.*

Jan. 27, 1879 Beloe, Charles H., *Lezayre, Livingston Drive, Sefton Park*, and 13, *Harrington-street.*

Dec. 10, 1866 Benas, Baron Louis, *Prince's Avenue.*

Jan. 9, 1882 Benas, Phineas A., 74, *Upper Parliament-street.*

Feb. 6, 1882 Birchall, Charles, 32, *Castle-street.*

Jan. 25, 1864 Birchall, James, *Kirkdale*, HON. SECRETARY.

Oct. 19, 1868 Bower, Anthony, *Vauxhall Foundry*, and *Bowersdale, Seaforth.*

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Jan.	27,	1873	Bremner, H. H., B.A., *Municipal-buildings, Dale-street.*
Oct.	30,	1882	Brook, R. G., *Wolverhampton House, St. Helens.*
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Oct.	30,	1876	Bulman, Richard, 18, *Chapel-street.*
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April	18,	1864	Burne, Joseph, *Royal Insurance Office*, 1, *North John-street.*
Oct.	17,	1881	Burton, Dr., 64, *Rodney-street.*
*May	1,	1848	Byerley, Isaac, F.L.S., F.R.C.S., *Seacombe.*
Jan.	7,	1884	Calder, Miss Fanny, 47, *Canning-street.*
Nov.	3,	1862	Cameron, John, M.D., M.R.C.P., Physician to the Southern Hospital, 4, *Rodney-street.*
March	4,	1872	Carter, W., M.D., B.Sc., LL.B. (Lond.), F.R.C,P. Lond.), 74, *Rodney-street*, VICE-PRESIDENT.
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Dec.	13,	1875	Cowell, Peter, Free Library, *William Brown-street.*
Jan.	7,	1884	Cradock, Miss, L.K.Q.C.P.I., 29, *Catherine-street.*
Oct.	6,	1863	Crosfield, William, *Stanley-street* and 16, *Alexandra Drive, Ullet-road.*
Jan.	7,	1884	Currie, John, *Bank of Liverpool, Water-street.*
Nov.	12,	1883	Daly, Chas., *Knowsley-buildings.*
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Nov. 1, 1875 Doyle, Jas. F., 4, *Harrington-street*, and *Merton-road, Bootle.*

Jan. 28, 1848 Drysdale, John James, M.D. Edin., M.R.C.S Edin., 36, *Rodney-street*, Ex-President.

*Nov. 27, 1848 Edwards, J. B., Ph.D. Gies, F.C.S., Professor Medical Faculty of Bishop's College, *Montreal.*

March 21, 1870 Edwards, Edward E. (Smith, Edwards & Co.), *Adelaide-buildings*, 4, *Chapel-street.*

Oct. 15, 1883 Edwards, Frederick Wilkinson, 2, *Canada Dock*, and *Fairhope, Victoria Park, Walton.*

April 7, 1862 English, Charles J., 23, *Oldhall-street*, and 26, *Falkner-square.*

Nov. 14, 1881 Evans, Geo. Eyre, 100, *Camden-street, Birkenhead.*

*Dec. 13, 1852 Ferguson, William, F.L.S., F.G.S., *Kinmundy House, near Mintlaw, N.B.*

Nov. 15, 1875 Fleming, E. L., F.C.S., *Borax Works, Old Swan.*

*Mar. 19, 1855 Foard, James Thomas, 4, *St. James's-square, Manchester.*

Jan. 12, 1874 Frost, John Pownall, 10, *North John-street.*

Nov. 12, 1877 Galley, Jno., 8, *Newstead-road.*

Nov. 13, 1882 Gardner, Willoughby, 18c, *Exchange-buildings.*

Jan. 26, 1885 Gaskell, W. Frankland, 57, *Mount Pleasant.*

*Feb. 6, 1854 Gee, Robert, M.D. Heidelb., M.R.C.P., Lecturer on Diseases of Children, Royal Infirmary School of Medicine; Physician Workhouse Hospital, 5, *Abercromby-square.*

Nov. 26, 1883 Gibson, R. J. Harvey, M.A., *University College.*

March 20, 1882 Gill, James, *Sailors' Home*, and 2, *Beech-mount, Beech-street.*

Oct. 29, 1877 Green, Robt. Frederick, 66, *Whitechapel.*

Oct. 29, 1883 Green, Charles H. (Messrs. Green, Hill & Co.), 7, *York-street.*

Nov. 16, 1874 Guthrie, Malcolm, 2, *Parkfield-road*, Honorary Treasurer.

Oct. 29, 1883 Guthrie, Mrs., 2, *Parkfield-road.*

Jan. 22, 1855 Hakes, James, F.R.C.S., *Latrigg, Aigburth-road.*
Oct. 18, 1875 Hale, Philip A., *Bank of England, Castle-street.*
*Jan. 21, 1856 Hardman, Lawrence, 35, *Rock Park, Rock Ferry.*
Dec. 10, 1883 Hargreaves, Jas., F.C.S., F.A.S., *Peel House-lane, Farnworth-by-Widnes.*
Dec. 13, 1875 Harpin, E., 46, *Onslow-road, Elm Park, Fairfield.*
Nov. 30, 1874 Harvey, Henry, M.B., 57, *Wavertree-road.*
Feb. 6, 1865 Hassan, Rev. E., 2, *Olive Mount, Wavertree.*
Nov. 13, 1865 Hayward, John William, M.D., 117, *Grove-street.*
Oct. 16, 1882 Herdman, W. A., D.Sc., F.L.S., F.R.S.E., Professor of Natural History, University College, 99, *Bedford-street.*
March 7, 1880 Hess, Leonard O., 51, *Bedford-street.*
Nov. 4, 1872 Hicks, John Sibley, F.R.C.S., F.L.S., 2, *Erskine-street.*
March 22, 1869 Higgin, Thomas, F.L.S., 33, *Tower-buildings,* and *Huyton.*
Dec. 28, 1846 Higgins, Rev. H. H., M.A. Cantab., F.C.P.S., *Rainhill,* Ex-President.
Jan. 13, 1879 Higgins, Henry Longuet (Messrs. Simpson & North), 3, *Water-street.*
Oct. 20, 1884 Highmore, J. Henry, 7, *Lilly-road, Fairfield.*
Feb. 18, 1878 Hilton, Benjamin H., Crown Life Assurance, 5B, *Exchange-buildings.*
Nov. 16, 1863 Holden, Adam, 48, *Church-street,* and 2, *Carlton-terrace, Milton-road.*
March 9, 1868 Holme, James, 10, *Huskisson-street,* and *Eldon-chambers, South John-street.*
Nov. 30, 1874 Holme, Rev. Arthur P., *Tattenhall, near Chester.*
*Dec. 14, 1862 Holt, Robert Durning, 6, *India-buildings,* and 29, *Edge-lane.*
Jan. 21, 1884 Hope, E. W., M.D., 35, *Bedford-street.*
Nov. 4, 1878 Howie, J. Muir, M.B., 86, *Prince's-road.*
March 10, 1879 Hughes, John W., *Hornby-road, Wavertree.*

Feb. 20, 1882 Hunter, Hugh, 25A, *Duke-street.*

*Nov. 13, 1854 Hunter, John, Member Historic Society, Pennsylvania, *Halifax, Nova Scotia.*

*April 29, 1850 Ihne, William, Ph.D. Bonn, *Villa Felseck, Heidelberg*, Ex-President.

Jan. 26, 1868 Johnson, Richard C., F.R.A.S., 16, *Cook-street*, and 19, *Catherine-street.*

Feb. 24, 1868 Jones, Charles W., *Field House, Wavertree.*

*April 4, 1852 Jones, Morris Charles. F.S.A., F.S.A. Scot., *Gungrog, Welshpool.*

Nov. 1, 1869 Kinsman, W. N., *The Tower, Sandfield Park.*

Nov. 3, 1873 Lee, Hamilton (Messrs. Lee & Nightingale), *North John-street.*

*Dec. 11, 1871 Leigh, Richmond, M.R.C.S., L.S.A., Physician to St. George's Hospital for Diseases of the Skin, 15, *St. James's-road*, Hon. Librarian.

Nov. 13, 1882 Levy, Philip S., 24, *North John-street.*

Nov. 3, 1884 Lewin, Walter, *Bebington.*

Nov. 14, 1881 Lloyd, Richard J., M.A., *Lombard-chambers, Bixteth-street.*

Oct. 31, 1881 Lodge, Oliver J., D.Sc., Professor of Physics, University College, 26, *Waverley-road, Sefton-Park.*

Dec. 1, 1879 Long, Rev. R. E., B.A., *Cambridge House, Upper Parliament-street.*

Feb. 7, 1881 Lovell, John, 17, *Gambier-terrace*, and "Mercury" Office, *Wood-street.*

Oct. 2, 1882 MacCunn, John, M.A., Professor of Philosophy and Political Economy, University College, *Ashton-street.*

Oct. 15, 1883 Macgregor, Miss Jessie, 153, *Bedford-street*, and *Elm Tree Studio, Elm Tree-road, St. John's Wood, London.*

Dec. 1, 1884 Mackay, Professor, University College, *Ashton-street.*

Jan. 23, 1882, Marcus, Heinrich, *Trafford-chambers*, 58, *South John-street.*

Jan. 26, 1885 Mark, Thomas Wm., *Woolton Mount*, *Woolton.*

Nov. 14, 1870 Marples, Joseph, 23, *Leece-street*, and *Carlton-road*, *Tranmere.*

Nov. 17, 1873 Marples, Josiah, *Melvill-chambers*, *Lord-street*, and *Broomfield*, *Egremont.*

Feb. 19, 1877 Marples, William, 8, *Mathew-street*, and *Alfred-road*, *Birkenhead.*

Jan. 21, 1889 Martin, Studley, 27, *Brown's-buildings*, and 177, *Bedford-street South.*

Oct. 20, 1879 McArthur, Charles, 18F, *Exchange-buildings.*

March 28, 1874 McCulloch, D. B., 23, *Queen-buildings*, *Dale-street.*

Oct. 17, 1881 McLintock, R., 8, *Balmoral-road.*

Oct. 30, 1882 McMaster, John Maxwell (Messrs. J. B. Wilson, Dean & McMaster), 22A, *Lord-street.*

Oct. 15, 1883 Mead, A. J., B.A., Wallasey Grammar School, *Liscard.*

Nov. 17, 1873 Mellor, James, Jun., *Weston*, *Blundellsands.*

Dec. 14, 1874 Mellor, John, *Stansty*, *Waterloo Park*, *Waterloo.*

Oct. 20, 1879 Mellor, Thomas, *Edgewater*, *Blundellsands.*

Oct. 31, 1859 Moore, Thomas John, Corr. Mem. Z.S.L., Curator Free Public Museum, *William Brown-street*, VICE-PRESIDENT.

Nov. 1, 1880 Morrow, John, *Lynwood*, *Priory-road*, *Broad Green.*

March 6, 1882 Morton, George Henry, 122, *London-road.*

Jan. 8, 1855 Morton, Geo. Highfield, F.G.S., 122, *London-road.*

April 16, 1849 Moss, Rev. John James, B.A., *East Lydford Hall*, *Somerton*, *Somerset.*

Oct. 29, 1850 Mott, Albert Julius, F.G.S., *Crickley Hill*, *Gloucester*, EX-PRESIDENT.

Oct. 31, 1881 Mount, Ed., *Oaklands*, *Aughton*, *near Ormskirk.*

Dec. 16, 1878 Murphy, Rev. P., *Seaforth.*

*Oct. 21, 1867 Muspratt, E. K,, *Seaforth Hall, Seaforth.*

Oct. 20, 1856 Nevins, John Birkbeck, M.D, Lond., M.R.C.S., late Lecturer on Materia Medica, Royal Infirmary School of Medicine, 3, *Abercromby-square*, Ex-President.

Feb. 6, 1865 Newton, John, M.R.C.S., 9, *Westcliffe-road, Southport.*

Jan. 21, 1884 Nicholson, Edward, F.C.S., F.I.C., Surgeon-Major Army Retired, 73, *Bedford-street.*

Feb. 18, 1878 Nicholson, Robert, 11, *Harrington-street.*

Nov. 2, 1868 Norrie, Rev. B. A. W., M.A. Cantab., The College School, *Huyton*

*Oct. 15, 1855 North, Alfred, 1, *Hanover-terrace, Notting-hill, London, W.*

Dec. 18, 1866 Owen, Peter (Farnworth & Jardine), *Liverpool and London Chambers.*

Nov. 2, 1874 Palmer, John Linton, F.S.A., F.R.G.S., Fleet Surgeon, R.N., 24, *Rock Park, Rock Ferry.*

Oct. 20, 1884 Parker, Geo., 15, *Normanby-street.*

Nov. 28, 1881 Parkyn, Jas., *Beaconsfield, Rake-lane, Liscard.*

Nov. 13, 1882 Paton, Rev. William, *Mossgill House, New Ferry.*

Jan. 9, 1871 Patterson, J., 16, *Devonshire-road, Prince's Park,*

Nov. 4, 1861 Philip, Thomas D., 49, *South Castle street*, and *Holly-road, Fairfield.*

Dec. 28, 1846 Picton, Sir James Allanson, F.S.A., Chairman of the Library and Museum Committee, 11, *Dale-street*, and *Sandy Knowe, Wavertree*, Ex-President.

Feb. 24, 1879 Plastow, William, 383, *Scotland-road.*

Jan. 21, 1884 Polack, Rev. J., B.A., 88, *Falkner-street.*

*Jan. 22, 1866 Raffles, William Winter, 34, *Belsize Park Gardens, London, W.*, and *Glan-y-mor, Penmaenmawr.*

Nov. 12, 1860 Rathbone, Philip H., *Greenbank Cottage, Wavertree.*

March 24, 1862 Rathbone, Richard Reynolds, *Beechwood House, Grassendale.*

*Nov. 17, 1851 Redish, Joseph Carter, Lyceum, *Bold-street.*

Oct. 31, 1881 Rendall, G. H., M.A., Principal of University College, 70, *Bedford-street.*

Oct. 31, 1881 Rennie, J. W., 54, *Foxhill-street.*

Nov. 29, 1869 Roberts, Isaac, F.G.S., F.R.A.S., *Kennessee, Maghull,* VICE-PRESIDENT.

Dec. 4, 1876 Roberts, Richard (Messrs. Roberts & Son), 18, *Hackins-hey* and *Mossley-hill.*

Jan. 10, 1876 Rogerson, George Russell, F.R.A.S., F.R.G.S., F.R.S.L., *Cook-street* and *Allerton.*

Oct. 29, 1877 Rosenheim, Jos. C., *Sunny Bank, Prince's Park,* and C14, *Exchange-buildings.*

April 18, 1854 Rowe, James, 14, *South Castle-street* and *Leyfield Grange, West Derby.*

Jan. 22, 1872 Russell, Edward R., "Daily Post" Office, *Victoria-street,* and 6, *Abercromby-square,* EX-PRESIDENT.

Feb. 18, 1878 Russell, W., Compton Hotel, *Church-street.*

Feb. 18, 1884 Rutherford, John, LL.B. Lond., 15, *Stephenson-chambers,* 25, *Lord-street.*

Nov. 12, 1883 Rutherford, Wm. Watson (Messrs. Miller, Peel, Hughes & Co.), *Eberle-street.*

April 7, 1862 Samuel, Harry S., 80, *Onslow Gardens, South Kensington, London.*

Nov. 29, 1880 Sang, Walter, 8, *Brompton Avenue, Sefton Park.*

Oct. 18, 1880 Schack-Sommer, Dr. (Messrs. Crosfield, Barrow & Co.), 323, *Vauxhall-road.*

March 19, 1883 Selwyn, Rev. E. C., M.A., The College, *Shaw-street,* and *Dingle Bank.*

March 19, 1866 Sephton, Rev. John M.A., *Liverpool Institute.*

Oct. 15, 1883 Sephton, Mrs., 90, *Huskisson-street.*

Dec. 2, 1878 Serjeant, Jno., 128, *London-road.*

Jan. 7, 1884 Sharp, W. E., 6, *Colonial-chambers,* and *Stoneleigh Cottage, Birch-road, Bebington.*

Jan. 7, 1878 Shearer, George, M.D., 178, *Upp. Parliament-st.*
Oct. 18, 1875 Simpson, James, 10, *Rumford-place.*
Nov. 26, 1888 Sinclair, W. P., M.P., 12, *North John-street*, and 19, *Devonshire-road.*
Oct. 31, 1881 Smith, A. T., Jun., 5, *Bentley-road.*
Dec. 10, 1866 Smith, Elisha (Messrs. Henry Nash & Co.), 12, *Tower-buildings, North.*
April 4, 1870 Smith, James, 9, *Lord-street*, and *Ribblesdale Villas*, 22, *Merton-road, Bootle.*
Feb. 28, 1868 Smith, J. Simm, 1, *Warham-road, Croydon.*
April 20, 1874 Snow, Rev. T., M.A., 12, *St. Paul's-square.*
Nov. 12, 1860 Spence, Charles, 4, *Oldhall-street.*
Feb. 10, 1862 Spence, James, 18, *Brown's-buildings, Exchange*, and 10, *Abercromby-square.*
Nov. 18, 1878 Steel, Richard, 18, *Hackins-hey*, PRESIDENT.
Feb. 19, 1883 Steeves, Gilbert M., 24, *Falkner-street.*
Oct. 29, 1888 Stretch, Wm. Knowles, 29, *Balmoral-road, Fairfield.*
Nov. 28, 1881 Sumner, R. M., 50A, *Lord-street.*
Feb. 18, 1878 Symes, Charles, Ph.D., *Park Way House, Park Way, Upper Parliament-street.*
April 17, 1882 Tapscott, W. W., 39, *Oldhall-street*, and 41, *Parkfield-road, Aigburth.*
Feb. 18, 1878 Taylor, Geo., 23, *Seel-street.*
*Feb. 19, 1865 Taylor, John Stopford, M.D.Aberd., F.R.G.S., *Rivelin, Richmond Park, Anfield-road.*
Feb. 19, 1877 Thacker, Reginald P., *Mandeville, Aigburth-road.*
Oct. 21, 1878 Thompson, J. W., B.A. Lond. and Victoria, 22, *Lord-street.*
Oct. 30, 1882 Thomson, W. J., *Exchange-buildings*, and *Ghyll-bank, St. Helens.*
Nov. 17, 1850 Tinling, Chas., *Victoria-street*, and 29, *Onslow-road, Elm Park.*
Dec. 4, 1876 Torpy, Rev. Lorenzo, M.A., *Setubal.*
*Feb. 19, 1844 Turnbull, James Muter, M.D. Edin., M.R.C.P., 86, *Rodney-street.*

Oct. 21, 1861 Unwin, William Andrews, 11, *Rumford-place.*

Oct. 20, 1879 Veevers, Samuel, *Huyton*, and 12A, *Manchester-buildings, Tithebarn-street.*

Nov. 15, 1880 Vicars, John, 29, *Seel-street.*

Feb. 24, 1879 Walker, R. S., Resident Secretary, General Insurance Co., 3, *Brunswick-street.*

Feb. 19, 1877 Wallace, John, M.D., *Gambier-terrace.*

Jan. 27, 1862 Walmsley, Gilbert G., 50, *Lord-street.*

Nov. 17, 1884 Watts, E. G. B., 5, *Canada-dock.*

Nov. 17, 1884 Wortley, Wm., *Walton Grange, Walton.*

Jan. 9, 1865 Walthew, William, *Phœnix Chambers*, and *Vine Cottage, Aughton.*

Oct. 30, 1876 Weightman, Arthur (Messrs. Field & Weightman), *Talbot Chambers*, 3, *Fenwick-street, W.*

Dec. 2, 1861 Weightman, William Henry, *Minster-buildings, Church-street*, and *Camidge-road, Seaforth.*

April 7, 1862 Whittle, Ewing, M.D., Lecturer on Medical Juris prudence, Royal Infirmary School of Medicine, 77A, *Upper Parliament-street.*

Nov. 13, 1882 Wightman, William, 17, *Park Way.*

Nov. 2, 1874 Wolf, Jas. O. de (Messrs. T. C. Jones & Co.), 26, *Chapel-street.*

Nov. 14, 1870 Wood, John J. (Messrs. Abraham & Co.), 20, *Lord-street.*

Nov. 29, 1875 Yates, D. E., 26, *Castle-street*, and 88, *Huskisson-street.*

Nov. 13, 1876 Yates, Edward Wilson, 37, *Castle-street.*

Nov. 2, 1874 Young, Henry, *South Castle-street.*

Oct. 30, 1882 Zicaliotti, Alexander, 60, *Cable-street*, and 7, *Grove Park.*

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33.—1880 Joseph Mayer, F.S.A., *Pennant House, Bebington.*

84.—1881 H. J. Carter, F.R.S., *The Cottage, Budleigh Salterton, Devon.*

85.—1881 The Rev. Thomas Hincks, B.A., F.R.S., *Stokeleigh, Leigh Woods, Clifton, Bristol.*

86.—1881 The Rev. W. H. Dallinger, LL.D., F.R.S., P.R.M.S., Wesley College, *Sheffield.*

CORRESPONDING MEMBERS.

LIMITED TO THIRTY-FIVE

1.—1867 J. Yate Johnson, *London.*

2.—1867 R. B. N. Walker, F.R.G.S., F.G.S., *West Africa.*

3.—1868 Rev. J. Holding, M.A., F.R.G.S., *London.*

4.—1868 George Hawkins, *Colombo, Ceylon.*

5.—1868 J. Lewis Ingram, *Bathurst, River Gambia.*

6.—1869 George Mackenzie, *Cebu, Philippine Islands.*

7.—1870 Rev. Joshua Hughes-Games, D.C.L., King William's College, *Isle of Man.*

8.—1874 Samuel Archer, Surgeon-Major, *Singapore.*

9.—1874 Coote M. Chambers, *Burrard's Inlet, British Columbia.*

10.—1874 Edwyn C. Reed, *Santiago de Chili.*

11.—1874 Millen Coughtrey, M.D., *Dunedin, Otago, New Zealand.*

12.—1875 Robert Gordon, Government Engineer, *British Burmah.*

13.—1877 Edward Dukinfield Jones, C.E., *Sao Paulo, Brazil.*

14.—1877 Miss Horatio K. F. Gatty, *Ecclesfield Vicarage, Wakefield.*

15.—1877 Dr. Allen, *Jamaica.*

16.—1877 Dr. George Bennett, *Sydney.*

17.—1877 Dr. David Walker, *Benicia, U.S.A.*

18.—1884 Rev. W. G. Lawes, *New Guinea.*

19.—1884 A. W. Crawford, *Oakland, California.*

20.—1884 John Greenwood, Mining Engineer, *Melbourne.*

21.—1884 Robert Abraham English, *Simla.*

ASSOCIATES.

LIMITED TO TWENTY-FIVE.

1.—Jan. 27, 1862 Captain John H. Mortimer, "America." (Atlantic.)

2.—Mar. 24, 1862 Captain P. C. Petrie, "City of London," Commodore of the Inman Line of American Steam Packets. (Atlantic.)

3.—Feb. 9, 1863 Captain James P. Anderson, Cunard Service. (Atlantic.)

4.—Feb. 9, 1863 Captain John Carr (Bushby & Edwards), ship "Scindia." (Calcutta.)

5.—Feb. 9, 1863 Captain Charles E. Price, R.N.R. (L. Young & Co.), ship "Cornwallis," (Calcutta and Sydney.)

6.—April 20, 1863 Captain Fred. E. Baker, ship "Niphon." (Chinese Seas.)

7.—Oct. 31, 1864 Captain Thomson, ship "Admiral Lyons." (Bombay.)

8.—April 13, 1865 Captain Alexander Cameron (Boult, English & Brandon), ship "Staffordshire." (Shanghai.)

9.—Dec. 11, 1865 Captain Walker, ship "Trenton."

10.—Mar. 28, 1868 Captain David Scott.

11.—Oct. 5, 1868 Captain W. H. Cawne Warren, ship "Bedfordshire."

12.—April 7, 1884 Captain G. Griffith Jones, barque "Hermine."

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SOCIETIES, ACADEMIES, AND OTHER INSTITUTIONS

TO WHICH THIS VOLUME IS PRESENTED.

Great Britain and Ireland.

Aberdeen - - - -	The Dun-Echt Observatory.
Alnwick - - - -	The Berwickshire Naturalists' Field Club.
Bath - - - - -	The Natural History and Antiquarian Field Club.
Belfast - - - -	The Naturalists' Field Club.
Belfast - - - -	The Natural History and Philosophical Society.
Birkenhead - - -	The Free Public Library.
Birkenhead - - -	The Literary and Scientific Society.
Birmingham - - -	The Philosophical Society.
Bristol - - - -	The Naturalists' Society.
Buckhurst Hill - -	The Epping Forest Naturalists' Field Club.
Chester - - - -	The Society of Natural Science.
Cambridge - - -	The Cambridge Union.
Dublin - - - - -	The Royal Irish Academy.
Dublin - - - - -	The Royal Geological Society of Ireland.
Dublin - - - - -	The Royal Society.
Edinburgh - - -	The Botanical Society.
Edinburgh - - -	The Geological Society.
Edinburgh - - -	The Meteorological Society of Scotland.
Edinburgh - - -	The Philosophical Institution.
Edinburgh - - -	The Royal Observatory.
Edinburgh - - -	The Royal Physical Society.
Edinburgh - - -	The Royal Scottish Society of Arts.
Edinburgh - - -	The Royal Society.

Falmouth - - - -	The Royal Cornwall Polytechnic Society.
Glasgow - - - -	The Philosophical Society.
Glasgow - - - -	The Geological Society.
Glasgow - - - -	The University.
Greenwich - - - -	The Royal Observatory.
Halifax - - - -	The Literary and Philosophical Society.
Hull - - - - -	The Literary and Philosophical Society.
London - - - -	The Anthropological Institute.
London - - - -	The Society of Antiquaries.
London - - - -	The Royal Institute of British Architects.
London - - - -	The Society of Arts.
London - - - -	The Royal Asiatic Society.
London - - - -	The Royal Astronomical Society.
London - - - -	The British Association.
London - - - -	The British Museum.
London - - - -	The Chemical Society.
London - - - -	The Royal Geographical Society
London - - - -	The Geological Society.
London - - - -	The Geologists' Association.
London - - - -	The Institution of Civil Engineers.
London - - - -	The East Indian Association.
London - - - -	The Linnæan Society.
London - - - -	The Meteorological Society.
London - - - -	The Society for Psychical Research.
London - - - -	The Royal Microscopical Society.
London - - - -	The Royal Medico-Chirurgical Society.
London - - - -	The Royal Society.
London - - - -	The Royal Institution.
London - - - -	The Royal Society of Literature.
London - - - -	The Statistical Society.
London - - - -	The Zoological Society.
London - - - -	The Editor of "Nature."
London - - - -	The Editor of "The Journal of Science."
London - - - -	The Editor of "Science Gossip."
London - - - -	The Editor of "The Scientific Roll."
Leeds - - - - -	The Philosophical and Literary Society.

Leeds - - - - -	The Yorkshire Geological and Polytechnic Society.
Leicester - - - -	The Literary and Philosophical Society.
Liverpool - - - -	The Architectural and Archæological Society.
Liverpool - - - -	The Chemists' Association.
Liverpool - - - -	The Engineering Society.
Liverpool - - - -	The Geological Society.
Liverpool - - - -	The Geological Association.
Liverpool - - - -	The Historic Society of Lancashire and Cheshire.
Liverpool - - - -	The Microscopical Society.
Liverpool - - - -	The Naturalists' Field Club.
Liverpool - - - -	The Philomathic Society.
Liverpool - - . -	The Polytechnic Society,
Liverpool - - - -	The Athenæum Library and News Room.
Liverpool - - - -	The Free Public Library.
Liverpool - - - -	The Liverpool Library.
Liverpool - - - -	The Lyceum News Room.
Liverpool - - - -	The Medical Institution.
Liverpool - - - -	The Royal Institution.
Liverpool - - - -	University College.
Manchester - - -	The Literary Club.
Manchester - - -	The Literary and Philosophical Society.
Manchester - - -	Chetham Library.
Manchester - - -	The Free Public Library.
Manchester - - -	Owens College.
Newcastle-on-Tyne -	The Natural History Society of Northumberland and Durham.
Oxford - - - -	The Ashmolean Society.
Oxford - - - -	The Union Society.
Penzance - - - -	The Royal Geological Society of Cornwall.
Plymouth - - - -	The Plymouth Institution.
Taunton - - - -	The Somersetshire Archæological Society.
Truro - - - - -	The Royal Institution of Cornwall.
Watford - - - -	The Hertfordshire Natural History Society and Field Club.

Welshpool - - -	The Powys Land Club.
Whitby - - - -	The Literary and Philosophical Society.

BRITISH COLONIES AND THE UNITED STATES.

Bombay - - - -	The Royal Asiatic Society.
Boston - - - -	The American Academy of Arts and Science.
Boston - - - -	The Massachusetts Board of Education.
Boston - - - -	The Massachusetts Board of Health, Lunacy, and Charity.
Boston - - - -	The Natural History Society.
Boston - - - -	The Public Library.
Buffalo - - - -	The Society of Natural Sciences.
Calcutta - - - -	The Asiatic Society of Bengal.
Calcutta - - - -	The Geological Survey of India.
Cambridge (*Mass.*) -	Harvard University.
Cambridge (*Mass.*) -	Museum of Camparative Zoology.
Cambridge (*Mass.*) -	The Peabody Museum of American Archæology and Ethnology.
Chicago - - - -	The Public Library.
Davenport - - - -	The Academy of Natural Sciences.
Melbourne - - - -	The Royal Society of Victoria.
New Haven - - -	The Connecticut Academy of Arts and Sciences.
New York - - -	The Academy of Sciences.
New York - - -	The Astor Library.
New York - - -	The American Geographical Society.
New York - - -	The City University.
New York - - -	The State University.
New York - - -	The State Library.
New York - - -	The American Museum of Natural History.
Otago - - - - -	The University.
Ottawa - - - -	Geological and Natural History Survey.
Ottawa - - - -	The Library of Parliament.
Philadelphia - - -	The Academy of Natural Sciences.

Philadelphia - - -	The American Philosophical Society.
Philadelphia - - -	The Franklin Institute.
Philadelphia - - -	The Pennsylvania Board of Public Education.
Philadelphia - - -	The Zoological Society.
Salem - - - - -	The American Association for the Advancement of Science.
Salem - - - - -	The Essex Institute.
San Francisco - -	The Lick Observatory.
Sydney - - - -	The Royal Society of New South Wales.
Sydney - - - -	The Department of Mines.
Toronto - - - -	The Canadian Institute.
Washington - - -	The Department of Agriculture.
Washington - - -	The Geological and Geographical Survey of the Territories.
Washington - - -	The Naval Observatory.
Washington - - -	The Smithsonian Institution.
Washington - - -	The Department of Ordnance; the Department of the Chief of Engineers; the Department of Agriculture; the Department of the Interior.
Wellington - - - -	The New Zealand Institute.

FOREIGN.

Amsterdam - - -	L'Académie Royale des Sciences.
Berlin - - - - -	Die Akademie der Wissenschaften.
Bordeaux - - - -	La Société des Sciences Physiques et Naturelles.
Brussells - - - -	L'Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgique.
Cherbourg - - - -	La Société Nationale des Sciences Naturelles.
Christiana - - - -	The University.
Copenhagen - - -	L'Académie Royale.
Copenhagen - - -	La Société Royale des Antiquaires du Nord.

Geneva - - - -	La Société de Physique et d'Histoire Naturelle.
Gottingen - - - -	Die Königliche Gesellschaft der Wissenschaften.
Grieswald - - - -	The University.
Harlem - - - -	La Société Hollandaise des Sciences.
Helsingfors - - -	La Société des Sciences de Finlande.
Königsberg - - -	Die Königliche Physikalisch-ökonomische Gesellschaft.
Milan - - - - -	Il Reale Instituto Lombardo.
Munich - - - -	Die Königliche Akademie der Wissenschaften.
Paris - - - - -	L'Ecole Polytechnique.
Presburg - - - -	Der Verein fur Natur und Heil-Kunde.
St. Petersburg - -	L'Académie Imperiale des Sciences.
Stockholm - - - -	L'Académie Royal Suedoise des Sciences.
Strasburg - - - -	La Bibliothèque Municipale.
Strasburg - - - -	Die Kaiserliche Universitäts und Landes-Bibliothek.
Tokio - - - - -	The University.
Toulouse - - - -	L'Observatoire Astronomique.
Vienna - - - -	Die Kaiserliche Akademie der Wissenschaften.
Vienna - - - -	Die Geographische Gesellschaft.

TREASURER'S ACCOUNT, 1883-84.

Dr. *The* LITERARY AND PHILOSOPHICAL SOCIETY, *in Account with* JAMES BIRCHALL, *Treasurer.* **Cr.**

1883–84.	£	s.	d.
Balance due to Treasurer at beginning of Session	6	10	1
To Cash paid D. Marples & Co. Limited (Printing Volume)	113	11	0
" " " Papers and Miscellaneous	16	0	6
" " Tinling & Co. (Printing Circulars)..........	10	5	0
" " Secretary's Expenses	17	18	0
" " Editorial Fee..............................	10	10	0
" " Librarian's Expenses (two years)...........	8	13	3
" " Treasurer's Expenses	0	17	0
" Doling (Refreshments)......................	32	13	6
" " S. Burke (Attendance)......................	1	17	6
" " Royal Institution (Rent).........	20	0	0
" " Miller (Repairing Clock)	0	5	6
" " Balance in Treasurer's hands	44	4	4
	£283	5	8

1883–84.	£	s.	d.	£	s.	d.
By Cash from Subscriptions:—						
31 Entrance Fees, at 10s. 6d...........	£16	5	6			
216 Annual Subscriptions, at 21s.........	226	16	0			
32 Arrears, at 21s.	33	12	0			
				276	13	6
Interest on Dock Bond..................................				6	12	2
				£283	5	8
Oct., 1884.—Balance forward..................	£44	4	4			
Dock Bond......................	150	0	0			
				194	4	4

Examined and found correct,

(*Signed*), E. DAVIES,

ISAAC ROBERTS.

PROCEEDINGS

OF THE

LIVERPOOL

LITERARY AND PHILOSOPHICAL SOCIETY.

ANNUAL MEETING—SEVENTY-FOURTH SESSION.

ROYAL INSTITUTION, October 6th, 1884.

RICHARD STEEL, PRESIDENT, in the CHAIR.

The Minutes of the last Meeting of the previous Session were read and confirmed.

The Honorary Secretary read the following Report:—

REPORT.

The Council of the Literary and Philosophical Society has the satisfaction of again congratulating the members upon the successful completion of another year's work.

Fourteen ordinary meetings were held during the Session now past. Subjects pertaining to General Literature formed the topics of seven Papers read at these meetings, and Science and Philosophy received attention in sixteen, in addition to the numerous Miscellaneous Communications which, being descriptive of the personal observations of the members, contribute in a great measure to the interest of the meetings and the vitality of the Society.

The Council notes with pleasure that an increasing number of members take part in the discussions, and that the ability with which these are maintained proves the existence within the Society of considerable intellectual vigour and powers of acute observation.

The large attendances which now mark the meetings are a further source of satisfaction to the Council. The average number present each evening during the last Session was not less than a hundred.

The enactment of the law instituting lady-membership was followed, early in the Session, by the election of five ladies, one of whom—Miss Jessie Macgregor—has since read an able and interesting Paper on "Scandinavian Mythology from the Picturesque Side," illustrated with an original design of her own. Twenty-five gentlemen were also admitted to the Society during the Session.

The Council has to record with regret the death of five members since the last Annual Meeting. Two of these, Mr. Alfred Higginson and Mr. Charles Edward Rawlins, deserve a brief memorial in this Report.

Mr. Alfred Higginson had been an active member of the old Natural History Society for eight years, previous to its amalgamation with the Literary and Philosophical Society in 1844. In 1877 he removed to London, when he was elected an honorary member, as an acknowledgement of the long and efficient services he had rendered to the Society. Three Papers by him will be found in the volumes of Proceedings, namely—"Experiments with Rotating Discs," 1863. "The Natural History of Chironomus Plumosus," 1865; and "Lurking Places for Infection in Dwellings and Towns," 1866. The Society is also indebted to him for numerous con tributions to its miscellaneous business; indeed there were few evenings when he did not bring forward something of special interest—some experiment or observation which had

engaged his attention. His mechanical ability was shown by the invention of several valuable surgical appliances, one of which, the Higginson syringe, is known and valued; while another, an instrument for the transfusion of blood, was for a long time the only instrument by which that operation was carried out.

His regular attendance at the meetings and long service in the Council, combined with his well-known scientific attainments, induced the members on more than one occasion to offer him the Chair, but his modest and retiring character disposed him to decline the honour, and he remained one of the Vice-Presidents until his connection with the Society practically ceased.

Mr. Higginson was born at Heaton Norris, in 1808, and received his early education from his father, who was at that time minister of the Stockport Chapel. He then became a medical student in the Derby Infirmary, and after further professional training in St Thomas's Hospital, London, and elsewhere, came to Liverpool as House-Surgeon of the South Dispensary. After entering upon private practice, he was appointed Surgeon to the (Royal) Southern Hospital, and this office he held until his departure from Liverpool. Mr. Higginson was connected by marriage with the well-known authoress, Miss Martineau, and her brother, the Rev. Dr. Martineau, one of the Ex-Presidents of this Society.

Mr. Charles Edward Rawlins, a life member, joined the Society in 1856, and at one time took an active part in its affairs, and served upon the Council. He was a frequent speaker in the discussions, and being a man of vigorous intellect and intense earnestness, his remarks were characterised by a thorough acquaintance with the subject, and an agreeable and effective delivery. His knowledge of political and commercial economy was very great, and any institution which was calculated to promote the study of these subjects

among his fellow-citizens received his cordial support. When the Constitutional aspect of the breach between the Northern and Southern States of America began to attract serious attention in this country, and the great staple trade of Liverpool was seriously endangered, Mr. Rawlins took up the question with his usual zeal, and the speeches he made when it was discussed in the Society will not readily be forgotten by those who heard them. An increasing deafness prevented his continuance of this active participation in the Society's affairs, and he retired with the regret and cordial sympathy of the members.

Fourteen ordinary members resigned during the Session, and as it was found desirable to revise the list, the names of twenty-one others, whose resignations have been omitted from previous reports, or who have become disqualified under Law II, have been removed.

Four corresponding members have been added to the seventeen already on the list, and one Associate. The Society now consists of 247 ordinary members, 37 honorary members, 21 corresponding members, and 12 associates.

The Honorary Secretary, as Treasurer *pro tempore*, also presented the Accounts for the past year, which were approved of and passed.

The following Office-bearers were then duly elected:— Vice-Presidents—Thomas J. Moore, Cor. Mem. Z.S.L., W. Carter, M.D., Isaac Roberts, F.G.S., F.R.A.S.; Honorary Treasurer—Malcolm Guthrie, J.P.; Honorary Secretary—James Birchall; Honorary Librarian—Richmond Leigh, M.R.C.S.E.; Members of Council—John W. Hayward, M.D., Professor Herdman, D.Sc., Principal Rendall, M.A., Henry Longuet Higgins, J. Sibley Hicks, F.R.C.S., F.L.S., Josiah Marples, Robert F. Green, Charles J. English. Rev. W. Stern, D.D., Edward Nicholson, F.C.S., F.I.C., Wm. A.

Unwin, Rev. R. E. Long, B.A., Richard J. Lloyd, M.A., Baron L. Benas.

The Associates of the Society were re-elected.

The President then delivered the Opening Address.*

FIRST ORDINARY MEETING.

ROYAL INSTITUTION, October 20th, 1884.

DR. CARTER, VICE-PRESIDENT, in the Chair.

Messrs. John H. Highmore and George Parker were elected ordinary members.

Rev. HENRY H. HIGGINS, M.A., described a number of rare Plants from the Botanic Gardens, exhibited by the Curator, Mr. Richardson.

Mr. R. J. HARVEY GIBSON, M.A., contributed a Paper on "The Nematocysts of *Hydra Fusca*."†

The Rev. H. H. HIGGINS, M.A., exhibited from the Free Public Museum, a series of Canadian Graptolites, recently received from Sir J. W. Dawson, and a series of Cumberland Graptolites, recently obtained from Mr. F. P. Marrat.

Mr. HIGGINS questioned whether the animal of the Graptolite was a true polype, or fully entitled to a place amongst the *Hydrozoa*. He also exhibited a fossil, bearing some of the characters of a Graptolite, which he had found in the Coal Measures at Ravenhead.

Mr. HIGGINS also exhibited some living Actiniæ, recently collected at Anglesea for the Museum Aquaria, by Mr. John Chard and Mr. James Wood.

Mr. T. J. MOORE announced that the Aquarium in the Free Public Museum was about to be re-arranged and

* See page 1. † See page 29.

enlarged. He exhibited a specimen of the Pudu Deer (*Pudua humilis*), from Chili, the smallest true deer known, recently added to the Free Museum. He also exhibited a series of horns of the Cervidæ generally, and pointed out the distribution of the genera in the Old World and the New.

Professor HERDMAN read a Paper "On a New Organ of Respiration in the Tunicata."*

SECOND ORDINARY MEETING.

ROYAL INSTITUTION, November 3rd, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

Captain Joseph Kenney and Mr. Walter Lewin were elected ordinary members.

The Rev. H. H. HIGGINS, M.A., exhibited a specimen of the Horse Mushroom, which had in its growth pushed upward a heavy stone flag.

Mr. HIGGINS also exhibited a rare Holothurian (*Rhopalodina*) from Kabenda, West Africa, which was presented to the Free Museum, some years back, by the late Mr. R. Keen.

Mr. F. W. EDWARDS read a Paper on "Technical Education on the Continent."†

THIRD ORDINARY MEETING.

ROYAL INSTITUTION, November 17th, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

Messrs. E. G. B. Watts and W. Wortley were elected ordinary members.

The Rev. H. H. HIGGINS, M.A., exhibited, from the Free

* See page 39. † See page 47.

Public Museum, some fine and rare Shells recently added to the collection, including examples of *Turbo Jordani*, *Cypricardia oblonga*, *Siliquaria anguina*, and *Trophon Gerversianus;* also a Sponge, *Patuloscula procumbens*, growing on a Pecten.

Mr. T. J. MOORE reported further contributions (Oct. 30, 1884) to the Free Museum, from Capt. Griffith Jones, barque *Hermine*, Associate of the Society. The present collection, like its predecessor, consisted largely of marine invertebrates. It was carefully prepared and accompanied by written notes and observations, and was made on a voyage to and from Chili, including a run up the Parana as far as Rosario. From the Parana, Capt. Jones brought two living specimens of Coypus or Nutrias (*Myopotamus coypus*). They had been brought up by hand, as the mother was killed for its skin, the under fur of the Coypus being of value. This fur was used in England, in the manufacture of beaver hats, before the application of silk waste for the same purpose. The living specimens have been placed in a suitable cage in the Museum Aquarium room.

Dr. NEVINS contributed a Communication on "The Four-penny Silver Coinage of Great Britain (Joeys)," recently withdrawn from circulation.*

Mr. J. T. FOARD read a Paper on "The Development of Personal Liberty in England from Egbert to the Petition of Right."

FOURTH ORDINARY MEETING.

ROYAL INSTITUTION, December 1st, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

Mr. J. Warner Clarke and Professor Mackay were elected ordinary members.

* See page 227.

Professor HERDMAN exhibited and described specimens of the Orchid *Coryanthes Maculata.** He also read a Paper on "A Phylogenetic Arrangement of Animals."†

FIFTH ORDINARY MEETING.

ROYAL INSTITUTION, December 15th, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

Mr. BALL contributed a Paper on "The Water Supply of Wallasey."

Mr. H. L. HIGGINS read a Paper on "The Comparative Ethics of Ancient Religions."‡

SIXTH ORDINARY MEETING.

ROYAL INSTITUTION, January 12th, 1885.

RICHARD STEEL, PRESIDENT, in the Chair.

Mr. E. NICHOLSON, F.C.S., F.I.C., read a short Paper on "The Current Coins of British India," illustrated with diagrams and specimens.

Mr. W. A. UNWIN read a Paper descriptive of his Visit to Canada with the British Association in 1884.

SEVENTH ORDINARY MEETING.

ROYAL INSTITUTION, January 26th, 1885.

RICHARD STEEL, PRESIDENT, in the Chair.

Messrs. W. Frankland Gaskell and Thomas W. Mack were elected ordinary members.

* See page 235. † See page 65. ‡ See page 153.

Mr. W. A. WALTHEW, in a brief Communication, pointed out the Infrequency of Collisions among the Asteroids, notwithstanding the proximity of their orbits.

Dr. HAYWARD called attention to a paragraph in the *Lancet* on "The Physiology of Mind," which led to some discussion.

A Paper was read on "The Relationship of Palæontology to Biology,"* by Mr. R. J. HARVEY GIBSON, M.A.

EIGHTH ORDINARY MEETING.

ROYAL INSTITUTION, February 9th, 1885.

RICHARD STEEL, PRESIDENT, in the Chair.

The Rev. H. H. HIGGINS, M.A., exhibited some large Crystals of Stibnite (Sulphide of Antimony) from Mount Nosang, South Japan, recently purchased from Mr. S. Henson, of London, for the Free Museum.

Mr. HIGGINS also exhibited the following: A specimen of Carmine Suberite Sponge, presented to the Museum by Dr. H. J. Carter, F.R.S., Hon. Mem. Lit. and Phil. Soc., Liverpool, one of the type specimens of a new species just described by him in the *Annals and Mag. of Nat. Hist.* for Feb., 1885, pp. 113, 114, under the name of *Suberites Wilsoni.*

"This species is remarkable for its beautiful carmine colour after drying, and this is so abundant that, although it parts with sufficient to tinge other sponges which may be in contact with it when preserved in spirit, this in no degree appears to affect its brilliancy on desiccation." It is named after Mr. J. Bracebridge Wilson, M.A., F.L.S., of the

* See page 105.

Church of England Grammar School, Geelong, Victoria, who had collected with great care, and forwarded to Dr. Carter, an extensive series of sponges from that coast.

A large and peculiar variety of Toilet Sponge, recently presented by Messrs. A. F. and H. Moore, sponge merchants, St. Anne Street, was also exhibited by Mr. Higgins.

Dr. WHITTLE exhibited a Microscope and appendages, made out of odd materials of various kinds, by Mr. Thomas Powell, a Shoemaker, who was present at the meeting.

Sir J. A. PICTON, F.S.A., read "Notes on the Proposed Cathedral for Liverpool." *

NINTH ORDINARY MEETING.

ROYAL INSTITUTION, February 23rd, 1885.

ISAAC ROBERTS, F.G.S., F.R.A.S., VICE-PRESIDENT, in the Chair.

Mr. B. L. BENAS read a Paper on "The Century of Caldcron." †

TENTH ORDINARY MEETING.

ROYAL INSTITUTION, March 9th, 1885.

RICHARD STEEL, PRESIDENT, in the Chair.

Dr. CARTER exhibited Seeds under growth of the Common White Mustard, sown at various depths, and made the following observations:—The Seeds were sown in fine

* See page 87. † See page 127.

garden mould, placed in a large cylindrical glass jar. The depths were as follows :—On the surface, half-inch deep, one inch, two inches, three inches, four inches, and five inches. These seeds were sown in each of these situations at noon on February 24th, 1885, the jar being placed in a warm study. The following are the dates of germination and appearing above the surface of the soil. Those on the surface were commencing to grow at 8 p.m. on the 25th, and were one inch long by 7 p.m. on the 27th. At 10 a.m. of the 27th, one of those at half an inch deep was breaking through the soil at the surface, and by 10 a.m. on the 28th all three of these were ⅛-inch high. By 7 p.m. on the 28th one of those at a depth of one inch was breaking through. At mid-day, on March 1st, one of those at two inches, and at a corresponding hour on March 2nd, one at three inches broke through the soil, the companion seeds of the group of three soon following in each case. None of those sown at a greater depth than three inches appeared above the surface up to March 6th. At noon on this day the mould was carefully removed from around these, when the following facts were observed. Growth had gone on to a considerable extent, and, contrary to expectation, the cotyledons were found to be unfolded (though less completely than in those which had broken through the surface), and to be of a pale green, though it did not seem possible that any light could have reached them. After exposure the green colour rapidly became more pronounced, but although the little plants inclined towards the light they did not grow at all in height. The stems were crooked, owing, apparently, to the various turns that had to be taken to overcome mechanical obstructions. Several of the stems of plants sown at different depths that were accidentally broken exuded from the broken surface drops of perfectly clear fluid that was found to be markedly acid. It was expected that the length of the

main root would bear some proportion (either direct or inverse) to the height of the stem, but this did not appear to be clearly the case.

It had been noticed that mustard seed grown on moistened cotton wool or tow had always been attacked by a parasitic fungus. No such parasite attacked any of those sown on or in earth. Either, therefore, the germs of the parasite were not present (which is hardly likely, as they are invariably present when tow or cotton wool is used instead of mould), or else fresh garden mould is antiseptic so far as such germs are concerned.

Professor HERDMAN announced that an Association of Liverpool Naturalists was about to be formed for the purpose of dredging the estuary of the Mersey and the neighbouring parts of the Irish sea, and making reports on local Marine Biology.

Mr. WALTHEW exhibited a mass of fibrous development of root, probably of trees, found enclosed in the common field drains in a peat meadow in Scotland, and forming a body of sponge-like consistency.

Mr. RUTHERFORD read a Paper on "The Book of Mormon."

A Paper was also read "On Three Books, purporting to be *The Book of Jasher*," * by Dr. NEVINS.

ELEVENTH ORDINARY MEETING.

ROYAL INSTITUTION, March 23rd, 1885.

RICHARD STEEL, PRESIDENT, in the Chair.

Mr. JOHN NEWTON, M.R.C.S., read a Paper on "The Armorial Bearings of the Isle of Man; their Origin, History, and Meaning."†

* See page 241. † See page 205.

TWELFTH ORDINARY MEETING.

Royal Institution, April 20th, 1885.

RICHARD STEEL, President, in the Chair.

The Rev. H. H. Higgins, M.A., exhibited some Fossil Fish, Aerolites, and a Belemnite, *Chiroteuthis*, shewing the hooks, from recent purchases made by him in London for the Liverpool Museum.

Mr. F. W. Edwards read a Paper on "Technical Education in England."*

THIRTEENTH ORDINARY MEETING.

Royal Institution, April 27th, 1885.

RICHARD STEEL, President, in the Chair.

Mr. W. Carter, M.D., B.Sc., LL.B. (Lond.), F.R.C.P. (Lond.), was unanimously elected President for the next two Sessions.

The following communication was then read—

NOTES ON VARIATION.

By the Rev. H. H. HIGGINS, M.A.

I exhibit this evening a series of twenty specimens of a well-known shell, *Voluta musica*, Lin., a native of the Antilles, and, until somewhat recently, supposed to be moderately constant in its characters. They were purchased by myself a few weeks ago from Mr. Sowerby, who stated that they had formed a part of a magnificent conchological

* See page 171.

collection made by Dr. Prevost, correspondent of the *Journal de Conchyliologie.*

It is probable the varieties included in the present series may have taken Dr. Prevost a long period to collect; for some of them he is known to have paid a large price, and more than one appears to be the type specimen named, described, and figured as belonging to a different species. Mr. F. P. Marrat has carefully worked out the synonyms of the series. To him, therefore, I may leave further details, and proceed to make a few remarks upon the conditions under which certain specific forms are known to vary or sport.

1. Species supposed to be moderately constant, and belonging to genera in which the forms are for the most part stable, may on better acquaintance prove to be liable to considerable variation.

2. The family of Volutes is divided into many genera and sub-genera founded on fairly sufficient conchological distinctions. Amongst them is the central genus, *Voluta,* consisting of three species, of which *V. musica* is one. (H. and A. Adams.)

3. In *Voluta musica* the variations exhibited extend to the chief of the characters on which a conchological specific diagnosis is commonly formed. The shape varies from fusiform to short and squarely angled; the size from that of an acorn to that of a good-sized lemon; the surface from smooth to strongly noduled; and from transversely striated to longitudinally ribbed; the colour from rich and dark maroon to a pale, creamy white; and the pattern from highly elaborate to no pattern at all.

4. Excessive variation does not necessarily destroy validity of specific character; except when two or more specific forms approach very closely.

5. It is a question of some interest whether between

widely different varieties of the same species, intermediate forms exist or have existed, connecting all of them by imperceptible gradations.

6. Here must be taken into account what may be termed geographical varieties, in which certain forms are peculiar to diverse and perhaps distant habitats. In such cases closely intermediate forms are not to be expected. More frequently there is a mixture of the two modes of variation, and a species highly variable in its own centre has distinct outlying varieties proper to other parts of the world. The conchologist will be immediately reminded of the Olives having their centre in Madagascar.

7. *V. musica* inhabits the Carribean Seas, and is not known to extend beyond its own region. The specimens before us may be examples of distinct races in which the peculiarities have been transmitted, so that in the locality for that variety many perfectly similar shells might be found. Or, amongst ordinary forms, occasionally may occur an abnormal variety: a solution which involves great dissimilarity between the parent mollusc and its offspring.

8. In other words *V. musica* may have become endued with a natural plasticity, rendering it liable to exaggerate in the progeny slight tendencies in the parent towards albinism or melanism, or to a greater or less degree of nodulous development, or of colour pattern.

9. What is this plasticity? We take up a shell, and are astonished to find that another example of the same species is somewhat different. Our wonder is altogether in the wrong place: it is the sameness that is astonishing; and our surprise may stand for a convincing testimony as to the ordinary stability of species. Journals are expected to record, for the benefit of the public, that in Mr. A.'s garden was seen a blackbird with a white feather in its wing. Now the laws which regulated the appearance of the white feather

had, in the embryo of the bird, a sphere of action not larger than the point of an eye-lash. Those laws were conditioned by heredity; but we do not get much satisfaction out of this; for, how arose the white-feathered ancestral blackbird ?

To reply to this question would lead us from my design, which is to point out the amazing stringency of the laws of hereditary development far beyond the conceivable action of molecular mechanics. We could as well conceive a mechanical power acting in the neck of an hour-glass capable of making the sands in the lower bulb take, grain for grain, the relative positions they occupied in the higher bulb.

We may, however, start with the admission that the normal hereditive energy tends to produce perfect likeness between parent and offspring, and proceed to examine the circumstances under which variations occur with the view of finding whether they are such as may account for a departure from the ordinary course.

Our thoughts naturally turn to animals under domestication, for in them variation seems to have hardly any limit. For obvious reasons it would be unprofitable to discuss this great subject; but a few remarks may be made on its confines.

The existence of a normal completeness, a kind of personal totality, in the hereditive energy possessed by plants is well known to gardeners. Once get a plant to break, *i.e.*, to vary in any one direction, they say, and you may do anything with it. The difficulty is in getting it to start. What is *that* which is lost when its integrity is tampered with? Why should not the plant be just as jealous of keeping up its strain after, as before, yielding in one point?

In the countless hosts of insects, apart from geographical varieties, there are probably no forms more conspicuously

variable than *Arctia caja* and *Abraxas grossulariata*, the garden tiger moth, and the gooseberry-bush moth. Whole cabinets might be filled with the varieties of either of these moths, and it can hardly be attributed to chance that both of them are associated with cultivation. No truly wild moth varies to a like extent; yet it does not in the least appear how the artificial environment should favour the instability. Out of a hundred eggs of a wild moth, a hundred typical forms would almost with certainty be hatched. Out of a hundred eggs of the garden tiger moth, laid by the same moth, there might be a difficulty in finding two alike. Stability has either never been reached, or it has been lost. The type form continues to be the type form, but produces offspring unlike itself.

A British beetle, *Doraci*, may be seen of the most various colours all on the same rootstock of an aquatic plant.

Helix nemoralis is an example of extreme variability. Mr. Bean, of Scarborough, had a cabinet full of its varieties. A corresponding shell in Cuba, *Helix picta*, is similarly variable. On my visit to the island, Professor Poey, of Havannah, shewed me a whole cabinet of varieties which he had collected. It would be interesting to know whether the eggs of the same example of *Helix nemoralis* produced varieties differing from each other as in the case of variable insects. The evidence seems quite clear that the varieties are not the results of environments.

It is satisfactory in the present day to be in no danger of such a criticism as—"it is only a matter of colour, and cannot be of any importance."

To return to our series of *Voluta musica*, I am inclined to believe that the variations, though extreme in form as well as in colour, are not to be attributed to the influence of environments. There is much to repay a careful study of the specimens, and I regret that Dr. Prevost's own notes on the

subject are not available. The only bad specimen, in which the outer coats have been eaten away by acid, shews that when the animal was young and the shell thin, the painting was laid on in zigzag lines, never seen in any variety of the adult *V. musica*, but characteristic in *V. vespertilio*, also a very variable species.

The Rev. H. H. HIGGINS, M.A., directed the attention of the meeting to a series of enlarged Biological Models, prepared by Messrs. Moore Brothers for use in the class room, and for other educational purposes. The series included coloured diagrammatic sections of the Lobster, Cockroach, Noctiluca, etc., and models of the nervous systems of the Leech, Mussel, Earthworm, etc., which were severally commented upon by Professor HERDMAN.

Mr. T. J. MOORE reported the presentation to the Museum (January 5, 1885) of a Collection of Specimens, chiefly Marine Dredgings and Skimmings, made on a voyage from England to Rio de Janeiro and Rangoon, in 1883–4, by Capt. W. H. Cawne Warren, Associate of the Society.

Mr. MOORE read a Paper on "The Rocky Mountain Goat; with Notes by Mr. St. George Littledale on specimens shot by him for the Liverpool Museum." *

The specimens, two in number, had been ably mounted by Mr. Henry Reynolds, the Museum taxidermist, and were exhibited to the meeting.

Professor HERDMAN contributed some observations on the minute structure and physiology of the flower of *Angræcum Sesquibedale*,† and also a Note on the Armature of the Branchial Siphon in some Simple Ascidians. ‡

* See p. 265. † See page 233. ‡ See page 205.

BETTER AND WORSE: THE INFLUENCE OF THE SENTIMENT OF VALUE ON HUMAN AND ANIMAL DEVELOPMENT.

By RICHARD STEEL.

In the address which I had the honour of delivering a year ago from the chair of this Society, I dealt with the proposition that there is no essential dissimilarity in mental constitution between man and those other animal forms which with him make up the sentient population of our planet. I argued that such differences as exist in this regard are differences in degree of development, rather than in kind and nature, and that as such they are not fundamental in their character. It is not to be doubted, however, that there are many who dissent strongly from this conclusion, and such persons may not unreasonably ask—*Whence, then, do we find such difference of external condition between man and the brute? Why is it that, whilst man keeps progressing in his external relations to the world around him, all other animal forms remain relatively stationary in their development? Why is it that man searches out the secrets of nature, and in some measure controls her forces, whilst other living beings remain content with their lot, and appear to follow, each in its own life history, with unchanging routine, the life history of its myriad ancestors in the past?*

I recognise fully the relevancy of such questions to the line of argument adduced on the occasion referred to, and the tenor of my address this evening, whilst not directed solely to their elucidation, will I hope supply in some measure an answer to such interrogatories.

It is necessary then, as preliminary to any enquiry having scope in this direction, to remember that we must not for any purpose of this kind attempt to compare extreme terms of the animal series with each other. We must not compare the civilized European with some of the lower forms of animal life, and dismiss with hasty scorn the idea that there is any analogy between the intelligence of a Newton and that of a bivalve. We must rather institute our comparison between man in his lowest condition and animals of the higher grades of sagacity. If we pursue this course, we find at once that the psychological difference between them, so far as there is any external evidence of such difference,* is greatly minimised and reduced. Some might, indeed, go so far as to say that the generous and intelligent dog, which will risk its life for the rescue of a human being from whom it has derived and expects no benefit, is psychologically superior to the degraded savage, who, like the black man of Australia or the Bushman of South Africa, manifests very few of those feelings and thoughts which are accounted honourable to humanity. But, without going to so great a length, we may at least assert that the mental distance between the lowest men and the highest form of animal life, other than man, is, so far as evidenced by their mode of life and external relations, comparatively trifling. The social conduct and organization of the ant-hill is removed by no material distinction from the corresponding status of the less elevated tribes of mankind.

If the position thus stated is correct, it follows that there is no breach of continuity as we pass from the external relations of the lower forms of life to those which are, as we know, characteristic of humanity. And thus the dissimilarities which come to view between man and the animal world upon the basis of such relations are strictly of the same kind

* It is with difference so evidenced only that I now feel called upon to deal.

as the corresponding differences between the less and the more advanced families of mankind. It follows, therefore, that these differences throughout the whole series, animal and human, are similar in their nature, and arise from an amplification of those agencies which, in speaking of human beings, we are accustomed somewhat vaguely to comprise under the term *civilization*.

It thus only remains for us in order to answer approximately those questions which I stated at the outset of this address, to determine the efficient cause which develops those conditions which we sum up under the head of civilization in human history. Upon this point there is no generally accepted theory whatever. But I believe that we shall find good reason to conclude that the chief source and essence of the difference between the less civilized and the more civilized races of mankind really consists in the less or more extended development of a conception which is present in a rudimentary form in even the least intelligent living beings, and which varies in man in a degree proportionate to his mental cultivation and enlightenment. The decadence of humanity from primæval bliss is associated with the knowledge of good and evil. The advancement of humanity in material respects is founded upon the perception of *better* and *worse*. And it is to this, which may be termed the conception of relativity of value, using the latter word in its widest and broadest sense, that all progress in relation to external conditions is mainly due.

Such a statement as that just made may sound somewhat paradoxical, but it is at least susceptible of easy illustration. The idea of relativity of value is one which is coextensive with conscious life. In the lowest forms of being it applies chiefly to food, and is evidenced only in the preference of one article of diet to another. As we rise in the scale of being we find the conception expanding into a

greater variety of preferences and influencing the animate being, not only in its choice of food, but also in the selection of its *habitat*, and, perhaps more important still, in its selection of a mate.* It thus becomes the great and all pervading directive influence, which gives the process of Natural Selection a persistent tendency in certain directions instead of leaving that process to take effect as a mere succession of accidents. And coming to the special case of the development of humanity, it may be seen as soon as stated that the difference between the savage, whose ideas of value extend only to a few rude articles, and the cultivated European, who places a value upon almost everything in the world around him, including the triumphs of art literature and science as well as the natural objects within his ken, is a difference which may be measured almost exactly by the relative development of view upon this head entertained by these two sons of Adam. Were it possible, indeed, by some process of mental photography to obtain an exact knowledge of the things, ideas, institutions, and so forth, which a given human being values, and the relative estimation in which he holds them, you would have therein an exact representation of the man himself, and such a portrait would leave unmarked no element of character which you ought to take into account in estimating his psychological status.

The theory just stated of the cause which underlies the differences which exist between living beings is, I believe, absolutely true, but it is unfortunately novel, and I am bound, therefore, to point to such verification of it as the case admits of. That verification may most conveniently be

* Did the proposed limits of my address permit it would be easy to show that some of the lower creation have still more advanced ideas on the subject of value. The fondness of the magpie and other birds for glittering objects is well known, and is strictly analogous to the value which savages place upon glass beads, and highly civilized persons upon precious stones. Birds, for the purpose of nest-building, choose always the best materials, although these must sometimes present to them every feature of novelty.

obtained by tracing the progress of the civilization of mankind, and by proving that this progress has always been bound up and associated with a corresponding degree of development of man's views with regard to comparative value. Such a task in its completeness would, however, be a vast undertaking, and I therefore merely ask the indulgence of the Society to-night whilst I survey this hitherto untrodden field of enquiry to such partial extent, and in such cursory manner as the convenience of our meeting will permit.

We may then, with advantage, commence our survey at that point of human development which most closely resembles the highest stage of life reached by the most intelligent of other animal forms. It is possible that there may have been a prior stage in the progress of humanity, during which the intelligence and mental capacity of man was below such a level. But of this we have from the nature of the case no record, and it would be but a waste of time to launch our retrospect into a problematic era, in which we should have to depend upon imagination for our facts. We begin, therefore, where we have some sufficient data to go upon. The wisest of men, King Solomon, tells us to go to the ant, to consider her ways and be wise, and, I think, we may see in the social condition of this wonderful family of insects a state not far removed from the earliest conditions of humanity of which we have any remaining evidence. Thus Professor Büchner puts before us sufficient proof of the fact that certain species of ants not only gather a particular sort of rice or corn, but that they also plant it, reap it when ripe, and practise with regard to it a systematic course of agriculture.* He further points out that it is a general practice amongst many tribes of ants to use Aphides and other myrmecophilous insects much as human beings do their milch cattle, housing them in some cases and providing them with nourishment on the one hand, and on the other drawing from them the

* *Mind in Animals*, pp. 113–115.

valued supplies of a coveted secretion.* And completing the analogy, both he and other observers tell us that two peculiarly human institutions, war and slavery, are also existent amongst some of these remarkable insects. They swarm forth in disciplined lines, attack the nests of other ants, destroy and disperse the adults, and bear off the pupæ in triumph to their own abode. Arrived at their nest they immediately hand over their booty to the slaves they previously possessed, and trouble themselves no more about the matter. A few days afterwards the stolen pupæ or nymphæ emerge, without memory of their childhood, and immediately and without compulsion take part in all tasks.†

I take it then that even those which are now the most advanced races of mankind furnished in their earliest state of which any evidence remains a close analogy to these conditions of the ant. Such a state of things may, indeed, be paralleled in some backward sections of the savage world at the present day, and all races of mankind which have risen above this level have evidently passed through it, as may be seen in the persistence, even amidst the highest civilization, of ideas of the primitive type.

It is not difficult to discern amongst the conditions just enumerated, those special agencies which became the original working factors in the development of such further progress as has been since achieved by humanity. With our modern notions it may, indeed, sound like a contradiction in terms to say that the practice of war was an important aid to early civilization, but such I believe to have been unquestionably the fact. The love of battle is an instinct which even now often underlies the character of strong and useful men, and without combativeness the human race could never have effected the progress it has succeeded in making. The advantage, moreover, of combining for the purpose of attack or defence developed the social spirit amongst those who so

* *Op. cit.*, p. 116, *et seq.* † *Op. cit.*, p. 143.

combined, although the ulterior object was the destruction of their fellow beings. No one can read the *Iliad* of Homer, for example, without perceiving, mirrored in the poetic truth of that great poem, the fact that men allied together for the purposes of war develop higher forms of character than can be attributed to the solitary savage who has not yet risen to any higher conception of battle than to lie in treacherous ambush for his foe, or than can be expected in Bœotian beings, to whom life is nothing but a dull round of endeavour to satisfy the lower requirements of animal nature. We rightly regard war now as an anachronism and a great evil. But our platform is far removed from that occupied by the human race in the days of which I speak, and that which is now a form of retrogression from a higher civilization, was then an advance from the still lower level from which humanity at some time emerged.

Out of war, slavery on the large scale sprung by a natural sequence. Domestic slavery, in the sense of the absolute domination of the male over the female, already existed, and was, as Sir John Lubbock tells us, an universal state of things in early times. And thus it came about that the warrior who at first beat out the brains of the vanquished with his club, and afterwards perhaps joined in the ghastly banquet of the cannibal, began by degrees to spare for his own convenience some whose age or sex would render them capable of sharing in that drudgery of which he had already reaped the advantage, and of which his mate had hitherto borne the entire burden. History, from the earliest date, puts slavery before us as one of the most universal of human institutions, and repulsive though such a system is to us in our more enlightened times, we are still, in my judgment, bound to regard it as a further step towards the development of mankind, as we now know the race in its higher stages of culture.

The ownership of slaves once established on the large scale, an idea of relativity in their value would obviously arise from individual differences of age and capacity. A rude barter in the captives of the bow and the spear thereupon naturally sprang up, and lent to the important and fundamental conception of value a more extended and definite form than it had hitherto possessed in the mind of man.

The state of mankind, intellectually, at this stage of their history, in which the most civilized races had not passed beyond the level which we have sketched, has not, as might be expected, left many traces which we can now recognise. The institution of private property, however, may be so regarded, and is probably the most ancient which remains to us. The trusted weapons with which he risked his life in battle, and the slave captured by his individual prowess, would naturally be regarded as the peculiar property of the warrior in a sense which in no respect attached to the land he cultivated, or to the flocks and herds, which were to some extent the property of his clan. With the first barter which arose as already referred to, language would necessarily receive an extension adapted to the requirements of exchange. An elementary arithmetic resulted from the exigencies of the case. And these items of intelligence, together with such knowledge as was involved in the construction of weapons of war and chase, comprehended, probably, the whole advance which had been established over the brute condition. The value of the slave, the value of weapons of the best quality, and the value of co-operation for the purpose of defence and attack, were the forms of thought which had thus far led humanity to a higher level.

It is in the nature of the commercial idea, when once

established, to grow and develop itself. Such a process became easy so soon as it had occurred to some profound person of the time, possibly one who was possessed of that discretion which is the better part of valour, that it was not necessary to attack a neighbouring tribe in order to obtain a few slaves. All that was necessary was to offer to the tribesmen in question something of which their supplies were scanty, and the desired result would be obtained with infinitely less labour and risk. It is thus, I think, hardly to be doubted that, though some neighbourly traffic existed from an early time in other articles between individuals, the slave-trade was the great original trade of the world. The human chattel possessed the peculiar advantage of transporting itself, and this species of commerce was probably therefore at first conducted much as it is in the backward districts of Africa at the present day.

The materials for a much more extended interchange lay, however, ready to hand. From the early times, when man shaped his arrow and spear heads from flint, he must have obtained some knowledge of minerals, and it is not surprising, therefore, to find that the original use of the more accessible and easily worked metals goes back to the most remote antiquity. In the metals and in slaves alone, commodity enough existed for the transaction of trade, but in addition to these the produce of the land, the trophies of the chase, and such animals as were then domesticated, furnished an ample variety of articles for the purposes of barter.

As soon, therefore, as the principal beasts of burden were domesticated, an extensive and varied commerce became possible and presently sprung up. With it extended the horizon of the views of mankind upon the subject of value, and a corresponding advance was established in human psychological development.

We thus find, in the very dawn of authentic history, that the traffic of the caravan was established as a medium of communication between the nations of the time. The earliest record we have of this species of commerce is to be found in the Book of Genesis and in connection with it the camel is repeatedly referred to. In the first catalogue of the possessions of Abraham* it occupies the place of honour in the list, standing, if we may attach any importance to the order of statement, considerably above the slave in value, the human possessions of the patriarch being curiously enough interposed between the *male* and *female* ass, the latter of which appears, both from this passage and others in the Book of Job, to have possessed a very special degree of value in patriarchal times. The camel, however, was much more useful than the ass in the larger commerce. It is a singular proof of the important influence which the domestication of this animal had upon human history, that the traffic, and with it the civilization of the ancient world, developed itself chiefly in the region of those countries which, from their partially desert character, were traversable only by its assistance. Thus we find the Chaldæans and the Arabians to have been the earliest merchants of antiquity. Chaldæa was indeed a fertile country but it bordered upon the desert, and of the two closely connected Semitic races it is evident that although the people of Mesopotamia early developed a genius for brick and for sculpture, they were on the whole surpassed by the Arabians as mere agents of exchange. Once possessed of the invaluable beast of burden to which I have referred, the sands of the desert, instead of being an obstacle to commerce, became an easily traversed highway in the days when roads were not yet formed, and when the very jungle and vegetation of more fertile districts must have been a serious obstruction to every form of transport.

* Genesis xii, 16.

No doubt, however, the contiguity of Arabia to Egypt had much to do with the development of early commercial enterprise amongst the children of the desert. Dean Howson has well described Egypt as the China of the ancient world,* so jealous were its people in their intercourse with strangers. But Egypt was nevertheless of old, even as it is now, a great corn-raising country, and as we learn from the interesting narrative of Jacob and his sons, distant tribes resorted thither for grain in times of scarcity. At the same time a large demand sprung up in Egypt for commodities which were not produced in the valley of the Nile. Myrrh, frankincense, and spices were required for the embalment of the dead—a process which we know was practised in the case of Joseph, and which appears to go back to the earliest date of Egyptian history. These spices were brought by the Arabian merchants from Arabia Felix, and thus these people became the principal agents in a commerce which exchanged the food of the living to procure the means of obtaining the preservation of the dead.

Coincident with the development of this international traffic of the ancient world, it is now important to note that corresponding further advances in knowledge and civilization were made in all those countries which were connected and traversed by the caravan routes. That elementary knowledge of mineralogy, to which I have already referred, increased as the metals became generally recognised as convenient *media* of value and exchange. The metalliferous vein, followed from its outcrop on the surface in its descent into the bowels of the earth, laid the foundation of a certain amount of engineering skill. The value of land in the delta of the Nile, where boundaries were obliterated by the annual inundation,

* *History of the Mediterranean Sea*, a Lecture, 1849.

gave rise, as Herodotus tells us, to the science of geometry.* And as the caravans of Asia wended their way during the night of the summer months† over those trackless deserts, which remain to this day in all their sublimity, the observation of the stars of heaven must have been the only means of guidance to the traveller, and must have helped to lay the foundations of the oldest of the systematic sciences—that of astronomy.

It is thus clear that a very great increase of human knowledge and advancement was the inevitable and certain result of the development of human requirements and notions of value up to the period that we have reached. And as this era of trade became absorbed into that which followed it—that in which maritime commerce began to be of more importance than the traffic of the caravan—we shall see that a further corresponding impetus was given to the development of humanity.

We do not of course know who was the adventurer who first dared the waves of the sea in his bark. Horace tells us in his well-known lines—

> "In oak or triple brass his breast was mailed,
> Who first committed to the ruthless deep
> His fragile skiff, nor inly shrank and quailed,
> To hear the headlong south wind fiercely sweep
> With northern blasts to wrestle and to rave."‡

and all succeeding generations have concurred in the poet's admiration of the courage of the early mariners. The ark of Noah is the first vessel of which we have any authentic

* Herodotus, Book 2, ch. 109.

† During the summer months of these regions the caravans start each day in the evening, and travel till six or seven a.m. of the following morning.

‡ *Ode to the Ship of Virgil.* Sir T. Martin's translation.

narrative, but if we may be permitted to draw an inference from a slight incident mentioned in connection with this primæval voyage, some knowledge of the art of navigation even then already existed. We read that Noah sent a raven and a dove out of the ark, the latter of which returned to it, and the former of which did not return at all.* Now it is known to be a fact that early navigators were in the habit of guiding themselves when out of sight of land in exactly a similar fashion. An early voyager to Iceland took crows with him, and used them for this purpose.† Pliny tells us that the people of Taprobane practised the same method.‡ And in the mythic Argonautic cruise we find a dove let loose as the voyagers near the Symplêgades.§ The fact of birds being employed at all by Noah, and the further fact that the birds made use of were the raven and the dove is too striking to be an accidental coincidence, and we may therefore probably infer that there were sailors before Noah and his sons.

However this may be, it is at any rate safe to assert that maritime adventure first originated in the broad rivers and narrow seas of Western Asia. The fishermen of the buried cities of the East had learned to face the dangers of the Euphrates, and it was by an easy transition that men who had braved the waves of their native river at last mustered courage to launch their vessels on the land locked sea of the Persian Gulf. There is evidence in any case sufficient to satisfy competent investigators that the chief maritime race of antiquity, the Phœnicians, were originally migrants from the shores of this ancient sea, and for many hundreds of

* This incident also appears in the account of the Babylonian deluge derived from Berosus, and in that deciphered by Mr. Geo. Smith from a cuneiform inscription.

† Lindsay.—*History of Merchant Shipping and Ancient Commerce.* Vol. i, p. 359.

‡ *Natural History.* Book vi, ch. 24.

§ Grote.—*History of Greece.* Part i, ch. 13.

years the history of the Phœnicians is the history of the most progressive race of the time.

Some of the earliest notices of this celebrated nation are to be found in the books of the Old Testament. Sidon is mentioned as one of the sons of Canaan, and the district or town, Zidon, was probably named after him, though there is apparently not sufficient reason to believe that he was the ancestor of the historical race which afterwards occupied it. The place, Zidon or Sidon, is referred to by name in a later chapter of Genesis, and is spoken of in the book of Joshua as great Zidon. A succeeding verse in this last case also speaks of the strong city Tyre, showing the high importance which these places had achieved at the time when the Israelitish invasion was chronicled. From this time forward the cities of Phœnicia are frequently referred to in the sacred books, and we learn from the books of Kings, Ezekiel, Amos, and Joel, that they were the seat of a great traffic in which slave trading was a conspicuous feature, thus bearing out as far as Tyrian and Sidonian adventure was concerned, that theory of the evolution of commerce which I have ventured to submit to you this evening. Homer refers repeatedly to Phœnicia. The Tyrian dye is mentioned in the *Iliad*, as are also the costly products of Sidonian looms. In the *Odyssey* we find Ulysses, in his narrative to Eumæus, attributing to the Phœnicians the offence of kidnapping children. Herodotus commences his history by laying upon this people the blame of the wars of the Greeks, arising out of the abduction of Io.* All ancient history however serves to show the immense importance of the influence this remarkable race exercised in the affairs of their time. And it is from our point of view to be noted that, just as they were the great traders of the day, so also were they the pioneers in the intellectual progress of their

* Herodotus, Book i, ch. 1.

age. The services which they rendered to geography were great beyond comparison. They surveyed the Mediterranean, colonised Carthage, Marseilles, and places of less note, reached even to the coasts of Britain, and according to some accounts circumnavigated Africa. Not only did they do a great coasting trade (for all maritime adventure was in those days of that nature), but they connected themselves at Tyre with the great caravan traffic of Asia, and at Carthage with similar caravans, which traded far to the south over the desert of Sahara. They appear, from passages in ancient authors to have also established considerable manufacturing industries, and were celebrated for their cloth and its magnificent dye, whilst we also know from abundant evidence that they were the great metallurgists of the time. Through their intervention the tin of Great Britain, and the silver and lead of Spain, became so well known in the Levant that of silver at least it is said that in its abundance it was nothing accounted of in the days of Solomon. And with all this they rendered the greatest of services to mankind in presenting to the world the gift of an alphabet, and thus making literature possible.

I must not, however, dwell longer upon the history of these cities and their people. I ask you simply to take note of the fact that in their case, at any rate, the intellectual and material advantage of mankind was distinctly connected with the expansion of that commerce which, though not its sole form, is still an important evidence of the development and more general application of the sentiment of value.

The next great state, or rather *congerie* of states, to which the course of history brings us is that of Greece; but before passing to the consideration of the evident connection between Grecian commerce and Grecian civilization I must devote a few words to the history of the Israelites, in this

regard, in the days of Solomon. Prior to the time of that monarch the people of Israel had not been a trading nation in any important sense of the term. Their wealth, such as it was, had been largely gained by war, and it would appear that their political state was essentially one of isolation. Whatever good they may have done as the custodians of a pure form of religion, their influence, in general respects, was certainly not much to the advantage of material progress. But in the reign of the wisest of their rulers all this was changed. During that reign, and that reign only, Israel became a great trading nation. A close alliance was set up between the chosen people and the neighbouring kingdom of Tyre, and, in this brief but magnificent episode, we have again established the connection which it is one incidental aim of my address this evening to exemplify.

Returning, however, to Greece, we find the same truth again confronting us throughout the whole range of Grecian history. That history extends over too long a period for it to be possible to attempt anything like a full review of its chequered course. We must content ourselves with remarking in the first place, that of all the States of Greece, Athens and Corinth were those in which the arts, and all that is most characteristic of Grecian civilization, attained their highest and most magnificent development. The city of Themistocles and Pericles was also, as we know, at the same time a most important trading centre, and it was during the very days when her commerce was at its height that Athens enrolled so many citizens on the foremost pages in the history of art and philosophy. The great trade of Athens was in corn, and it is noteworthy that the first mercantile exchange of which we have any record was a portico upon the Piræus, where the business of Asia Minor, the Black Sea, and Greece proper was transacted by Hellenic merchants.

Pericles, the greatest of Athenian statesmen, had a keen perception of the value of commerce, and it was to him and to Themistocles that the honour of constructing the port of the Piræus was actually due. The period of the greatest commerce of Athens was contemporaneous with the highest distinction of that city for the intellectual and artistic achievements of her citizens, and with the decadence of her commercial primacy came also her declension to a lower level in every intellectual respect. Corinth, to which I have already shortly referred, was, like Athens, distinguished among the states of Greece alike for her commerce and for those developments of architectural and artistic genius* which form so large a part of the claims which ancient Greece has established upon the admiration of posterity. And thus in the history of these two states we read again the lesson which it appears to me is taught by the whole tenor of the past. The special secret of Grecian influence upon civilization consists in the circumstance that whilst perpetuating and extending the commerce of the world, the people of her most advanced communities had also awakened to the beauty and value of poetry, art, philosophy, and literature, and placed themselves in a position to bequeath to posterity the imperishable evidences of their success in these fields of genius and endeavour.

The brilliant career of Alexander the Great brings Grecian history, so far as our subject is concerned, to a termination. The greatest conqueror the world ever knew was the pupil of its greatest philosopher. Aristotle did more for science than can be credited to any other Greek writer, and we find practically summarised in his works all that ancient Greece achieved in this particular direction. Alexander, in his remarkable career, carried Greek learning

* It is said that the art of painting was first practised in Corinth. Singularly enough no Corinthian literature remains to us.

into the heart of Asia, and it is evident that his perception of the value and importance of commerce was unusually keen. His empire fell to pieces at his death, and the chief monument which he has left behind him is the city of Alexandria in Egypt, which he founded for commercial purposes, and which he had the sagacity to see would become the centre of a great and growing trade. Not only were his anticipations in this respect fulfilled in the most ample manner, but Alexandria also became distinguished as the greatest intellectual centre and seat of learning upon the shores of the Mediterranean. Amongst her many illustrious names, that of Euclid remains to us as that of the greatest and most original of the mathematicians of antiquity.

We must now pass in our survey to that period when Rome began to assert that wonderful supremacy which for centuries is the most salient fact of history. From our point of view the history of Rome divides itself naturally into two eras. During the former of these, which we may consider as enduring till somewhat after the time of Cato the Censor, and the end of the third Punic war, the Romans were never, in proportion to their success in other respects, a trading nation; nor was their country one in which literature and the arts found a congenial atmosphere. In their national career they indeed exhibited upon a grand scale that order of the evolution of human material progress which was suggested at an earlier stage of this address. The first great fact we practically know about the Romans, standing in the foreground of a vast amount of legendary matter, is that they were engaged in constant wars, and that a keen perception of the value of military success and military glory was the key-note to their early national character. And though the Romans did not perhaps practise domestic slave-owning and the traffic in slaves to a larger proportionate

extent than nations less successful in the art of war,* it was, nevertheless, their constant aim to bring all neighbouring nations into a state which was practically that of servitude. We thus find that their views upon the subject of tribute and subsidies were of the most systematic and practical character. The chief trade of Rome, therefore, during this early period, consisted in the import of corn from her dependencies, and really represented the exactions she made from conquered nations rather than any genuine commercial spirit.

It might indeed be asserted, with some show of truth, that at this period of her history Rome did more harm than good to the cause of material progress generally. Syracuse, originally a Grecian colony, and a city which had attained great eminence in trade, was conquered and reduced to insignificance by her, and we know that Syracuse had, in the person of her famous son, Archimedes, evidenced strongly that connection between the development of knowledge and the development of commerce which is so striking a fact in human history. Archimedes placed mechanics upon a scientific basis, discovered the principal laws of hydrostatics, and carried mathematical science to a degree of perfection from which little further advance was established till the time of Galileo, many centuries afterwards. The conquest of Syracuse was not, moreover, the only blow which Rome inflicted upon the growing commerce of the Mediterranean sea. We have already seen that Corinth had played a most important part in the advancement of the world's material interests, and Corinth was completely destroyed by the Roman arms. A still greater loss, however, to the cause of human progress, consisted in the destruction of Carthage—a

* The number of the Roman slaves was, nevertheless, very great. Gibbon estimates that in the time of the Emperor Claudius the slaves were at least equal in numbers to the free inhabitants of the Roman world.—Vol. i, ch. 2.

destruction so complete that all we know of that famous Phœnician colony is derived from the contemporary records of other countries, none of her own people having remained to write her history. It is said that Cato concluded every speech he made in the Roman Senate, whatever the subject, with the words—"*Ceterum censeo, Carthaginem esse delendam.*"* Not only must this have been tedious in the extreme to his auditory, but, in the interests of civilization, it is to be regretted that his advice was finally acted upon with such unrelenting thoroughness.

In spite, however, of the havoc which Rome wrought so widely upon communities more industrial than her own, it would be taking a superficial view of the case to underrate the influences for good which were the outcome of her empire. We must remember always, in the expansion of our subject, that commerce, in its bare details, is only one expression of the idea of value, and it is not difficult to show that the achievements of Rome in other respects were highly beneficial to the cause of progress. The Romans were a great engineering race, in this respect far excelling any which had either preceded or were contemporaneous with them. They constructed military roads in every country in which they fought, and even in this way conferred advantages the value of which it would be difficult to overestimate. Their works of public utility in Rome and elsewhere were on the most extensive scale, showing that their views on the subject of value, if they did not take entirely the commercial groove, were, nevertheless, practical and far reaching in the extreme. During that later period of Roman history, of which I have spoken incidentally, Rome supplies indeed lessons in this regard, which we, amidst our more modern civilization, have never yet thoroughly learned, and may still study with advantage. It is one of the great wants, for example, in our large

* For the rest, I vote that Carthage must be destroyed.

cities and their suburbs, that so little provision is made for the personal cleanliness of the people. We have to read, every summer, a long catalogue of deaths from drowning in turbid pits and canals. We know that in the cottage houses of the poor there are no possible facilities for ablution, and we provide for the exigencies of the case upon an infinitesimal scale. We take care that the working man shall have a public house at the corner of every street, and an inn upon every country high road, but if he wishes to *wash and be clean* he finds that the opportunities afforded him for the purpose are very much more limited, and, either upon the score of distance or expense, practically unavailable to himself and his family. The Romans dealt with this matter in a much more public-spirited fashion. They would appear to have valued cleanliness more than we do. One of their public baths alone, that of Caracalla, in Rome, was, in extent of the area covered, more than four times the size of our St. George's Hall, and that building, of which we are so justly proud, is indeed architecturally a reproduction of these baths upon a smaller scale.

While the facts just referred to furnish some evidence of the useful direction which Roman progress assumed, we must not forget that during this later epoch of her history, with which we are now dealing, Rome became a great commercial state. In addition to this it must be remembered that during her Augustan age she produced a great literature. At the time when the splendour of the empire was at its height, and when the universe was ransacked to minister to the luxury of the wealthy, the poetry of Virgil and Horace, and the efforts of many great Roman orators and writers served to show that the lessons of Greek civilization had not been lost upon the conquerors of Greece. Rome cultivated indeed literature and the arts in the very spirit of the goddess Minerva herself, taking care always that the

spear and the shield lay ready to her hand. And the Romans deserve also, throughout their whole history, the high credit of perceiving, more strongly than any nation had hitherto done, the value and importance of administrative vigour with its necessary adjunct, a complete and systematic jurisprudence. These are not showy things, but they lie at the foundation of all settled government and the firmer coherence of states since the Roman era is due to the example which Rome exhibited, and the lessons which she inculcated.

With the decadence of the Roman empire, human progress for a time stood still. A large commerce established its seat during these troubled times at Constantinople, but there would appear on the whole to have been a retrograde tendency in the pursuits of peaceful traffic and industry, accompanied by a corresponding stagnation in the intellectual world.

It is not indeed until we come to the rise of the Italian Republics, that we find proof of any further great movement in the path we are tracing. But during the history of these states a fresh impetus was given to the cause of knowledge, refinement and commerce. The most important of them—Venice—rose from the waves of the Adriatic as Rome sank beneath the final invasions of those barbarian hordes who overwhelmed the eternal city. Without going too much into detail, it is sufficient to remark that from about A.D. 450 to the time when the passage to India round the Cape of Good Hope was achieved by Vasco de Gama, Venice Genoa Florence and Pisa raised the peninsula to an eminence and influence upon the cause of civilization which all the power of the empire to which they succeeded had not enabled it to equal. In these cities learning and art achieved

advances such as have been effected at few periods of history. A former President of this Society, the celebrated William Roscoe, tells us that during the time of which he writes, a time falling within this period, "almost every city of Italy was a new Athens, and that favoured country could boast its historians, its poets, its orators, and its artists, who may contend with the great names of antiquity for the palm of mental excellence, . . . Venice, Milan, Rome, Florence, Bologna, Ferrara, and several other places vied with each other, not in arms, but in science and genius, and the splendour of a court was estimated by the number and talents of learned men who illustrated it by their presence."* Macaulay writes of the same period, "To collect books and antiques, to found professorships, to patronise men of learning, became almost universal fashions among the great. The spirit of literary research allied itself to that of commercial enterprise. Every place to which the merchant princes of Florence extended their gigantic traffic, from the bazaars of the Tigris to the monasteries of the Clyde, was ransacked for medals and manuscripts. Architecture, painting, and sculpture were munificently encouraged. Indeed, it would be difficult to name an Italian of eminence during the period of which we speak who, whatever may have been his general character, did not at least affect a love of letters and of the arts." †

These were the palmy days of the intellectuality of Italy, and they were also the days during which her commerce was without a rival in the Mediterranean. Her greatest writers, Dante, Petrarch, and Boccaccio, and her greatest artists, Leonardo da Vinci, Raphael, and Michael Angelo, with many other stars which would have been of the first magnitude in a less brilliant firmament, all flourished during the period when the merchants of the Italian states were the

* Roscoe: *Life of Lorenzo de Medici.* † *Essay on Machiavelli.*

merchant princes of the world, and the great men whom I have named more especially, were all, without exception, either natives of the foremost commercial states or in any case resided in them.

It was not, however, only in the fine arts that mediæval Italy excelled. We find in the later years of this era the germs of modern science, though it was not until sometime afterwards that much actual progress was made in this direction. Galileo, a Florentine, is the father of experimental physics; and Leonardo da Vinci, amongst other conceptions of his universal genius, strenuously asserted that the contents of the rocks were real shells, and maintained the reality of the changes of the domain of land and sea which these spoils of the ocean imply, thus laying, in some measure, the foundation of geological science. Anatomy also began to assume its modern phase, and the medical schools of Italy were then the most celebrated in Europe, as indeed they seem to have continued to be for some time afterwards, our own illustrious countryman, Harvey, the discoverer of the circulation of the blood, having completed his education at Padua.

Contemporary, to a large extent, with the revival of learning and the extension of commerce in Italy, a similar movement took place both amongst the followers of Mahomet in Asia and amongst the trading communities of North-Western Europe. "During the reign of the Khalifs, Bagdad, Cairo, Bussorah, Aleppo, and Damascus were centres of a great commerce, and both they and many other cities of note, not only possessed collegiate establishments, but also contained a number of learned men who formed the most distinguished part of the community, and the seats of government became the resort of poets, astrologers, astronomers, and philosophers from all parts of the

world."* We owe to this revival of Arabian commerce and intellectual activity some notable additions to the sum of human knowledge. Gibbon tells us that the science of chemistry owes its origin and improvement to the Saracens.† It is certain that we also derive from this race our numerals, and with them the possibility of modern arithmetic. It is a singular reflection that learned mathematicians, who had traversed nearly the whole field of plane geometry, who understood the conic sections, and who had investigated the properties of complicated curves and spirals, did not know as much arithmetic as would have enabled them to pass the sixth standard at a Board school in the present day. Such was, however, nevertheless the case, the cumbrous Greek and Roman notation being a bar to progress in this direction and we may thus see the importance of the service which, in this one circumstance, we derive from Arabian culture.

In the north of Europe, as already observed, a simultaneous wave of progress followed the industry of Flanders and the commercial activity of the Hanse towns. The glories of Gothic architecture rose during the twelfth and following centuries as mute but magnificent monuments to that connection between commerce and culture which I have already illustrated with an iteration which is now becoming tedious. Scholars and artists—Erasmus and Rubens, Tycho Brahe and Kepler, flourished during the later centuries, when the Low Countries still held the commercial primacy of the world, and furnished fresh proof of the truth that the world's greatest men are inspired by the age in which they live, and render back, in the efforts of their genius, a harvest which has ripened in receptive and fecund minds from the thought-germs of their day and generation.

* Chesney: *Countries between the Nile and the Indus*, pp. 690, 691.

† *Decline and Fall of the Roman Empire*, Ch. 52.

From this time forward we enter upon a still newer and more expanded epoch in the history of civilization. The voyage of Vasco de Gama opened up the sea-road to India; the discovery of Columbus brought a new world into relations with the old. The developments of civilization and of commerce become so much more extended when this era is reached, that it is impossible to continue my slight sketch any further upon comprehensive lines. Enough has, however, been put before you to illustrate the position I have laid down, and I will therefore bring my historical references to a conclusion. It is sufficient merely to remark, in completion of these references, that our own country took from the first a strong lead in the matter of ocean commerce, and that the history of trade in this latest period has been, in the main, the history of British adventure. The last century has added to ocean traffic, and those other forms of commerce which preceded and still exist collaterally with it, the immense further advantages which engineering science—the invention of steam and its application to locomotion—have placed at the disposal of mankind. And it is a matter which is almost within the reach of our personal knowledge that within these last few generations art knowledge and commerce have gone hand in hand, and have derived from each other their principal support and encouragement. New sciences have sprung up, old sciences have ripened to a rapid maturity, literature has assumed new forms, and appeals to an immensely increased circle of readers. New and expanding ideas of value have become attached to education, to sanitary matters, and to many social modifications for the good of mankind. And an easy analysis would show us that, as in the past so also in the present, the same sentiment is still the active and potent agency which lies at the foundation of that continued extension of the power of man over the realms of nature, and that continued change in his external relations

to the world around him, which were the phenomena for which, at the outset of my address, I proposed in some degree to account.

From the biological point of view, by far the most important conclusion to which we are led is, that the psychological cause of human development and improvement, so far as external relations are concerned, is absolutely identical with the faculty or directive motive which underlies the whole process of Natural Selection in all living beings. It is an error to imagine, as is implied in one of those supposititious questions which are stated at the commencement of my address, that man is the only living being who has established a certain degree of psychological progress. His progress has been more rapid, and has certainly been more evident to himself, than that of any other form of life; but this is all that can effectually be claimed. So that in effect we are thus led again by an unaccustomed road to contemplate that unity of animate nature, the perception of which was present to the mind of the author of the world's first literature,* and which is one of the most striking facts which science in the present day is constantly tending to elucidate.

It is evident farther, in view of the whole tenor of my argument, that a correct theory of value is of supreme importance as underlying in some measure all branches of knowledge, as standing in important relation to every art and every science, and as being, indeed, the highest generalization to which all knowledge can be subjected. To those who are accustomed to associate the idea only with the more sordid relations of humanity such a conception may no doubt be unwelcome. But even those who would deny that commerce has been the parent of the arts and sciences, will at least

*Thus we find that the first *covenant* was established not with man only, but with all living beings.—*Genesis* ix, 12 *et seq.*

admit that she has ever been their foster-mother. The evolution of the sentiment with regard to which I have said so much was naturally largely to be found in the development of trade, from the fact that the more extensive the dealings of men with each other the wider and broader grew their notions of value. But from things which are material the idea passes to those which are more refined. Instead of value being merely a branch of political economy, men learn the lesson that political economy is but a department of that wider science of value which has yet to be constructed. They awaken to the supreme importance of the nobler traffic, which consists in the interchange and currency of great ideas, and they find their wealth in the appreciation of all that is best and most excellent in the world of thought as well as in the world of natural objects.

Nor must we suppose, as we look towards the mists which hang around the future of humanity, that there is no higher standpoint still than the loftiest that man has yet imagined. Though our present views of value are more refined and enlarged than those of the early fathers of our race, it may well be that those who are to follow us, and even we ourselves in some future condition, will look back upon our present ideas as inadequate and incomplete. It is enough to believe that as we struggle upwards, with shortening breath, those mists and clouds will clear away from around us, and that new beauties and new glories will reveal themselves in the ever-widening landscape to our vision.

OBSERVATIONS ON THE NEMATOCYSTS OF *HYDRA FUSCA*.

By R. J. HARVEY GIBSON, M.A.

NOTWITHSTANDING that a considerable amount of attention has been paid by students of the Coelenterata to the subject of nematocysts, there are various points of detail both in the anatomy and physiology of these bodies concerning which differences of opinion exist. The following observations were made more in the hope of definitely determining certain debated points than with the expectation of discovering any details which had hitherto escaped notice.

In the present instance *Hydra fusca* was chosen as the subject of experiment, not only on account of the large size to which the nematocysts attain in that form, but also because of the transparency of the tissues and the ease with which a supply of living specimens of all ages could be obtained.

The method employed was simple in the extreme. In each case an entire Hydra was mounted in water and examined living. Subsequently a reagent was added by the "irrigation" process, and the effect observed. The exact changes due to the addition of the reagent could in this manner be accurately determined.

The Hydra, when examined living, under a moderately high power (Hartnack objective No. 7—eyepiece No. 3), exhibits a distinct division into two parts; (1) a distal part, which appears more transparent and does not seem capable of such active changes of form as (2) the more opaque proximal portion. The transparency of the distal division seems, on examination, to be mainly due to the excessive vacuolation of

the endoderm cells. The ectoderm cells are there shallow and hyaline in appearance. The nematocysts occur in both distal and proximal portions, but more abundantly in the latter. The palpocils are entirely absent from the ectoderm of the *body* of Hydra (at least in all the specimens I have examined); they are, however, specially numerous in the tentacles. The palpocils (Fig. 14) are apparently, as stated by Allman and others, simple processes of the cuticular layer which covers the ectoderm cells on their exposed surfaces. I have, however, observed these palpocils in very young Hydræ, where no cuticle could be distinguished; and there they seemed perfectly continuous with the protoplasm of the ectoderm cells.

They are apparently sensory in function, and may perhaps be looked upon as pseudo-podial processes of the ectoderm cells, which become stiffened (possibly along with the superficial layer of the protoplasm of the cell itself) in the process of growth.

On surface view the ectoderm cells of the body generally and of the tentacles, especially in their contracted condition, are seen to be polygonal in form and elongated transversely, and to contain a variable number of nematocysts (Fig. 1). These appear as rounded or ovoid bodies lying quite irregularly in the protoplasm. As a rule one or two large nematocysts occupy the centre of the cell, and are surrounded by a number (usually about a dozen) of small nematocysts, varying in size from a mere granule, indistinguishable from the granules of the general protoplasm, to a capsule half the diameter of the large nematocysts. Often one sees, on surface view, a distinctly rounded vacuole, occupying a position in the cell occupied in others by a large nematocyst. The significance of this feature will be afterwards seen.

When seen in optical (vertical longitudinal) section the ectoderm cells are cubical or columnar in outline (Fig. 2),

their inner terminations forming the neuromuscular layer of Kleinenberg, their outer aspects rounded and, in older cells, covered apparently with an exceedingly thin cuticle, which is probably simply the modified external layer of the protoplasm, and from which the palpocils (in the tentacular ectoderm) project. Like the endoderm cells, the ectoderm cells also are vacuolated, and are seen to contain, in addition to the nematocysts, a large nucleus containing a nucleolus, and often one or more endonucleoli.

The nematocysts are distributed irregularly through the protoplasm, the only constant feature in their arrangement being the usually superficial position of the larger ones. The nematocyst is commonly surrounded by a thin layer of protoplasm, which separates it occasionally from one or more vacuoles in the body of the cell. In other cases, the nematocyst lies in a mass of protoplasm which cannot be distinguished from the protoplasm of the cell. In some cases I have been able to make out that, as frequently stated, the nematocysts lie in special nucleated cells, which are developed in or between the ectoderm cells; but this is not an absolutely uniform character. On the contrary, very many isolated nematocysts show no special nucleus, although they may be seen to carry with them occasionally the nucleus of the ectoderm cell, and one or more young nematocysts.

The structure of the nematocyst at rest has already been worked out very fully by Allman, Kleinenberg and F. Schultze, but there are still one or two points which appear worthy of reinvestigation.

In some specially large Hydræ I was able, by the use of eosin, to make out distinctly the anatomy of the resting stage. The nematocyst (Fig. 3) consists of an oval capsule, with a firm, more or less elastic, transparent wall. Occasionally the capsule is surrounded by a clear crescentic space, which intervenes between the capsule and the protoplasm of

the ectoderm cell. At the narrower end of the capsule, a distinct depression can, under a high power (Zeiss $\frac{1}{12}$ in. oil immersion) and with very careful focussing, be made out; and on one side of the rim of this depression an appearance is presented of a discontinuity in the substance of the capsule.

In the interior of the capsule there are various structures, the relationships of which can be very well made out by the use of eosin as a dye. They consist, firstly, of a "pharynx," or funnel-shaped membranous tube, passing down from the above-mentioned depression, which, after extending downwards for about one-third the length of the capsule, becomes enveloped in a general mass occupying the remainder of the space. The membranous tube is continuous with the capsule, though much thinner than it is. I could find no appearances which justified me in believing that the pharynx was continuous with a delicate membrane lining the entire capsule, as insisted on by Allman. The continuity of capsule and pharynx can be distinctly made out in large exploded and unexploded nematocysts, and this view, as will be afterwards seen, is supported by the facts of development. The mouth of the pharynx is shut by the slightly depressed part of the capsule above referred to.

When the pharynx is examined with very high powers, it is seen after a slight bulging to narrow considerably at its inner end, and to enclose an arrow-head-shaped process, pointing towards the superficial depression. This "arrow-head" can be distinctly made out to be formed of pointed processes, which spring by broadened bases from the sides of the pharynx at the point where it begins to narrow. These pointed processes lie side by side, and are succeeded in the narrow portion of the pharynx by one or more "arrow-heads" of small dimensions. It is also possible to make out that the pharynx is continued downwards as a very narrow

tube to the base or broad end of the nematocyst, where it bends and coils upwards in a spiral manner round the central portion of itself. The coil is perfectly regular, and resembles a pile of cable on shipboard. Occasionally the coil is very compressed. I have not been able to see the termination of the coil, however.

The other nematocysts in the ectoderm cell vary in structure, and will be described under the head of Development.

When the preparation of living Hydra is "irrigated" with dilute acetic acid, a change is at once produced in the nematocysts. This change, (which does not occur on *all* occasions on the addition of acetic acid) is a difficult one to understand, and it occurs with such rapidity that most observers have been baffled in their attempts to see what *actually* takes place. The change consists in the eversion of the part which has been termed the pharynx, together with an enormously long thread. Before endeavouring to explain the mechanism of discharge, it will be advisable to describe the structure of the exploded nematocyst (Fig. 4). The capsule is now empty, and presents a more elongated appearance. From its narrower end there projects what is recognisable as the pharynx of the resting stage, but turned outside in. The arrow-heads have resolved themselves into backwardly projecting spikes, which are arranged in circles of three each, and in front of which the tube now swells in a manner corresponding to the bulge it exhibited at the origin of the spikes in the resting condition. There are minor bulgings in front of the lesser spikes, which correspond to the lesser "arrow-heads." The everted pharynx becomes rapidly pointed, and its point is continuous with a very fine homogeneous-looking thread, often twenty times the length of the capsule. At the junction of the capsule with the everted pharynx, there is to be seen the lid above mentioned. This projection has none

of the functions of a "trigger," sometimes ascribed to it; it does not, indeed, appear until all use for a "trigger" is past. It is undoubtedly pushed up by the points of the spikes which, perhaps, continually exert pressure on it, owing to the tension of the pharyngeal tube. That some such pressure is in this way constantly applied previous to eversion, is apparent from the fact that the length of the spikes, when measured after the nematocyst has exploded, is greater than the length of the everted pharynx from the point of attachment of the spike to the lip of the capsule. (I must admit, however, that I was not able to satisfy myself with regard to these measurements in all cases.) The pharynx must, therefore, have contracted somewhat after eversion. The diameter of the mouth of the pharynx after eversion is greater than it is before eversion, but the diameter of the capsule is less after than before. The wall of the capsule in the resting state is therefore probably tense also, and must exert through the contents of the cyst additional pressure on the "lid" of the pharynx. Allman states that the capsule is often twice as large in its evolved as in its unevolved condition, and that the capsule never suffers collapse. The behaviour of the capsule after evagination is entirely dependent on the density of the fluid in which it is lying; and the changes which take place are comparable to those seen in the well-known experiments with coloured blood corpuscles. When the fluid is water, diminution in size is the general result, not unfrequently followed, after some time, at least in the larger nematocysts, by collapse and wrinkling of the capsule.

The pharynx is undoubtedly evaginated; the evagination of a thread of such extreme fineness and length is more difficult to comprehend. Being doubtful as to the possibility of such a process taking place under such conditions, I tried various methods, whose object it was to render the evagina-

tion so slow that the process might be watched. I was unable, however, to obtain any satisfactory result. Finally, it occurred to me that the process might be arrested at different stages by the use of osmic acid. I accordingly stimulated the tentacle of a living Hydra with acetic acid, and followed up the addition of acetic acid by the immediate application of a small drop of one-quarter per cent. of osmic acid. On examining the specimen, the method was found to be successful. The most of the nematocysts were arrested in the act of exploding; some had only the pharnyx evaginated; some had, in addition, a thread about four times the length of the capsule protruding, and that thread was double the usual thickness of the entirely everted thread (Fig. 7). In others a very peculiar appearance was presented; the evagination of the thread had been arrested in its last stage, and the ordinary thin thread had a long club-shaped extremity. In most of these club-like ends (Fig. 6), and also in the partially everted threads, with careful focussing there could be distinctly seen another thread, which was distinguished by its possessing a faint spiral twist. There seems to be little doubt that we have here a demonstration of the complete eversion of the thread of the nematocyst in its entire length.

Some time after the phenomena of normal eversion on acetic acid stimulation have taken place, the whole capsule together with a variable amount of adhering protoplasm is slowly ejected from the ectoderm cell. The surface of the cell presented no rupture, but there is usually left a distinct vacuole or space where the nematocyst was (Fig. 1, right-hand cell). Probably this vacuole after a time disappears; but no observations were made on that point. The ejected nematocyst not unfrequently carries with it the nucleus of the ectoderm cell (Fig. 4), but whether this be normal or an abnormal result of the method of stimula-

tion employed I cannot say. Occasionally in the protoplasm which the nematocyst carries with it there are embedded one or two young nematocysts of different sizes (Fig. 4). With regard to the *normal* stimulants which bring about the explosion of a nematocyst I am unable to give a definite opinion. Everything seems to point towards the process being a "vital" one, and under the command of the Hydra. One would *à priori* suppose infusoria to form a suitable article of diet for a Hydra, yet I have seen frequently very large hypotrichous infusors (probably Euplotes) wandering all over the body of the Hydra without the Hydra making the slightest effort to catch or sting them. They occasionally ventured on the tentacles, but seemed repelled by the palpocils; certainly no thread-cells were, so far as I could see, "fired" at them. I found one or two of these infusors on many of the Hydræ, and the actions of the infusor, and the passive manner in which the Hydra received its attentions irresistibly suggested commensalism; no doubt, as my friend, Professor Herdman, suggested, the Euplotes was receiving nourishment from some ectodermic excretion. Should this explanation be a correct one, it is interesting to find the principle of commensalism exemplified by animals so low in organisation.

From this it seems probable that though the forces which bring about the evagination of a nematocyst may be physical, they are under command of the Hydra. The initial act in the process is the dissolution of continuity between the "lid" and the capsule on one side. It is just possible that the Hydra may be able to bring about this dissolution by chemical transformation of the protoplasm in the immediate vicinity of the thread-cell.

The ejection of the spent nematocyst may be explained in the same way as the exuviation of useless cells, or cell-products, in the higher animals is explained.

I have not been able, in the Hydra I examined, to observe the stages in the development of the nematocyst as described by Allman, and repeated by other writers; nor am I able to identify as a distinct variety of nematocyst the smaller elongated bodies Allman describes as occurring in Hydra. He states (monograph on Hydrioda, Ray Society) that each consists of oval capsule enclosing a spirally-coiled thread, without any "barbed sac" (pharynx); that the straight portion, which is continuous with the capsule at its upper end, crosses diagonally outside the spiral. This "second type" of nematocyst seems to be merely an earlier stage in the development of the ordinary nematocyst.

The development (Fig. 8–13) begins with a granular differentiation of the protoplasm in any part of the cell. The granule (Fig. 8), which is bright and transparent, increases in size and developes into a circular sac (Fig. 9). At one point an invagination takes place, and a coiled finger-like process is pushed down into the sac (Fig. 10). This process increases in length, and coils round and round the central tube (Fig. 11). Ultimately a body is formed identical with the second type of nematocyst, save that the pharynx is central within the coil, and not eccentric and without it (Fig. 12). The capsule is at this stage a longish oval. It subsequently broadens and becomes more rounded (Fig. 13); the central pharynx widens and there appears in it the "arrow-heads" of the adult form. The spikes are, therefore, developed last of all. It is perfectly possible to cause these incompletely developed nematocysts to evaginate also, and when they do so they of necessity show no barbs—these not being developed until a later stage.

I am indebted to Professor Herdman for permission to make these observations in the Zoological Laboratory of University College, Liverpool.

Since the above paper was written, I have had further opportunities of studying the relationship of the Infusor mentioned as a possible commensalist of the Hydra. On one large Hydra I found no less than seven Euplotes; and I was astonished to find that not only did they wander over the *body* of the Hydra, but seemed to be equally at home on the tentacles, on which there were the usual large number of palpocils. Further, on careful examination, the Infusors were found to *contain* many nematocysts, large and small, which were obviously swallowed. The Infusors are, therefore, not commensalists, but parasites. Why the Hydra does not discharge nematocysts at them, and why the nematocysts themselves do not explode in the interior of the Infusor, seems to me a mystery. The physiology of nematocysts is thus a subject which can scarcely yet be said to be definitely known.

Description of Plate.

Fig. 1.—Surface view of two ectoderm cells. (Grundlach, $\frac{1}{12}$-inch. Hartnack eyepiece, No. 3.)

Fig. 2.—Vertical longitudinal optical section of ectoderm cells. (Hartnack No. 7, eyepiece No. 3.)

Fig. 3.—Nematocyst isolated, unexploded (Zeiss, $\frac{1}{12}$-inch oil immersion. Hartnack eyepiece, No. 3.)

Fig. 4.—Nematocyst isolated and exploded. (Zeiss, $\frac{1}{12}$-inch oil immersion. Hartnack eyepiece, No. 3.) [The thread is not represented, but would, if drawn to scale, be three times the length of this Plate.]

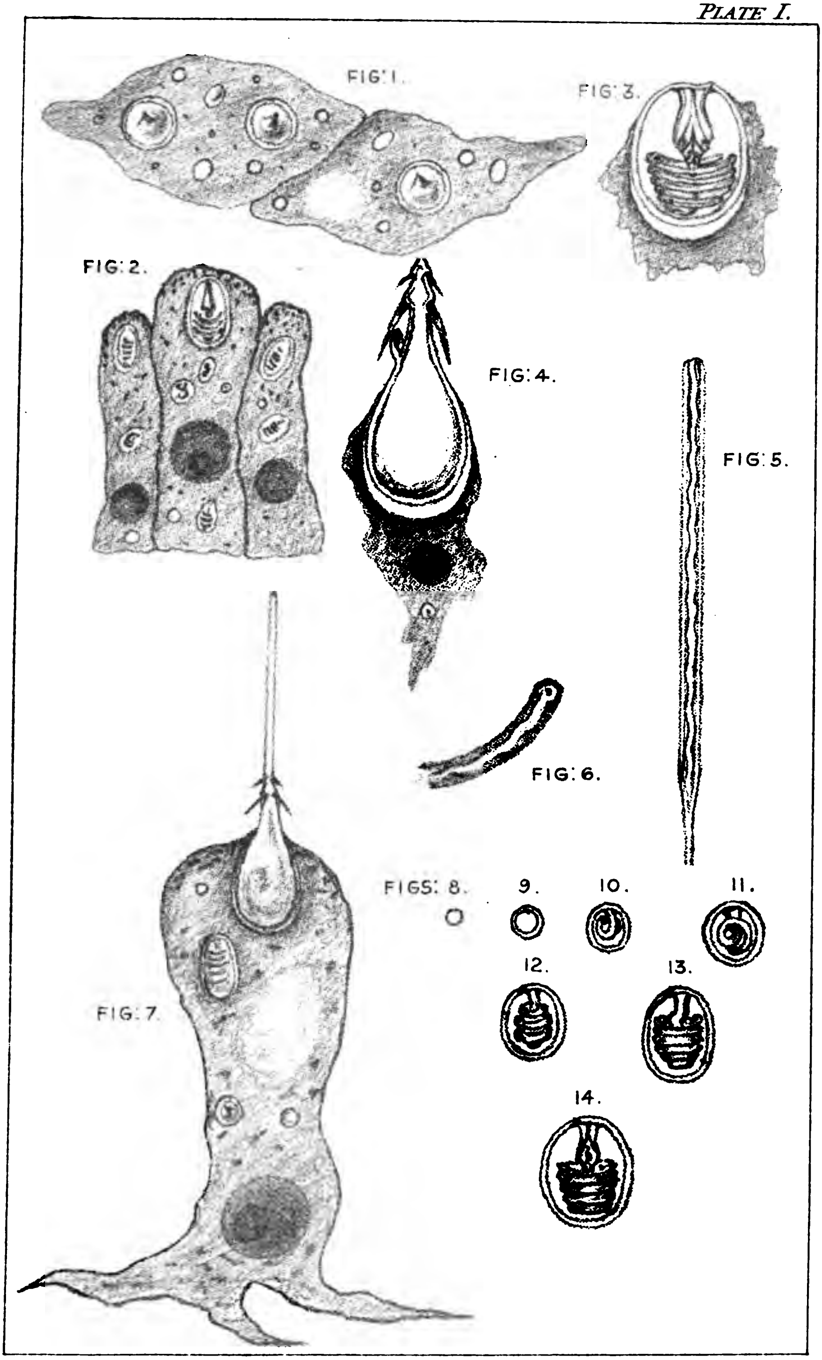
Fig. 5.—Club-shaped end of partially everted thread, after treatment with acetic and osmic acids. (Zeiss, $\frac{1}{12}$-inch oil immersion. Hartnack eyepiece, No. 3; tube drawn out.)

Fig. 6.—Partially everted thread, end view. (Grundlach, $\frac{1}{12}$-inch. Hartnack eyepiece, No. 3.)

Fig. 7.—Ectoderm cell, with partially exploded nematocyst, *in situ*. (Grundlach, $\frac{1}{12}$-inch. Hartnack eyepiece, No. 3; tube out.)

Figs. 8–13.—Stages in the development of a nematocyst. (Zeiss, $\frac{1}{12}$-inch oil immersion. Hartnack eyepiece, No. 3.)

PLATE I.



R J.H.G. Del.

ON A NEW ORGAN OF RESPIRATION IN THE TUNICATA.

By W. A. HERDMAN, D.Sc., F.L.S.,
PROFESSOR OF NATURAL HISTORY IN UNIVERSITY COLLEGE, LIVERPOOL.

It is well-known that the test or outer tunic in most Simple Ascidians is penetrated by a system of branched tubes containing blood. These so-called "vessels" were shown in 1872, by O. Hertwig,* to be developed as ectodermal evaginations, containing prolongations from one of the blood sinuses of the underlying mantle (see Plate II, fig. 1.) After ramifying through the test they are found to terminate, generally close to the outer surface, in rounded enlargements or bulbs, usually known as the terminal knobs (see Plate II, fig. 2). Each vessel is divided longitudinally by a septum of connective tissue † into two distinct tubes, which join in the terminal knob, the septum ending at the commencement of that enlargement. The blood currents differ in direction on the two sides of the septum, and change with the reversal of the heart, so that each tube functions as an artery and as a vein alternately (compare Plate II, figs. 1 and 2). This system is usually regarded as being merely the blood supply to the test; but Lacaze-Duthiers ‡ has pointed out that the hair-like projections from the test in most Molgulidæ are merely special developments of the terminations of the vessels, and I have suggested § that they are also homo-

* Untersuchungen über den Bau und die Entwickelung des Cellulose-Mantels der Tunicaten. *Jenaische Zeitschrift*, Bd. vii, p. 46.

† Fig. 1 shows how this septum is formed, while fig. 2 represents it in the fully developed condition.

‡ *Archives de Zoologie expérimentale et générale*, vol. iii, p. 314, 1874; and *Comptes rendus*, t. lxxx, p. 600, 1875.

§ *Proceedings* Royal Society, Edinburgh, 1879–80, p. 719.

logous with the vessels in the stolon of the Clavelinidæ from which buds are produced.

The extent to which this blood system of the test is developed varies greatly in different species of Simple Ascidians. In some, such as *Ascidia plebeia* and *Corella parallelogramma*, it is very rudimentary, if indeed it can be said to be present; while in others, such as *Ascidia mentula*, *Ascidia meridionalis*, and *Ascidia reptans*, Heller, the test is penetrated in all directions by a well developed system of tubes, with large and numerous terminal knobs. And a series of Simple Ascidians could be formed showing all conditions between the two extremes. The various species differ also in the prevalent arrangement of the vessels in the test, their mode of branching, and the relative numbers and sizes of the terminal knobs; but the most interesting modifications are those met with in the members of the remarkable genus *Culeolus*, deep-sea Ascidians which were discovered during the voyage of the "Challenger." † In one of these species, *Culeolus murrayi*, (see Plate II, fig. 3) the test is moderately thick, and throughout its greater part vessels are but rarely met with. On the outer surface, however, they expand into numerous large closely placed thin walled chambers, which in their turn communicate with large hollow papillæ projecting from the surface of the test and bounded merely by thin membranous walls. In the second and only other large species with a thick test, *Culeolus wyville-thomsoni*, vessels are numerous through all parts, and terminal expansions on the outer surface are rare. In the test, however, and usually deeply situated, there are large cavities or reservoirs full of yellowish brown blood corpuscles, and appearing to the eye as minute brown dots scattered thickly over the light grey test. In this species

† See *Zoological Reports of the "Challenger" Expedition.* Part xvii, p. 90.

there are also found in connection with the terminal twigs of the vessels in the superficial layer (Plate II, fig. 4) numbers of minute thin-walled finger-like processes projecting from the surface. They are only found in the hollows and grooves, which are numerous on the test of this species, probably on account of the protection afforded to them in such spots. These delicate processes doubtless represent the large papillæ of *Culeolus murrayi*.

When I first saw the above described arrangements of blood cavities in sections it occurred to me that the system might act in these species as an accessory organ of respiration, and I suggested this possibility in the Report upon the "Challenger" Ascidiæ Simplices, published in 1882.*

Since then my further investigations into the structure of the Tunicata, and especially of the Compound Ascidians, have greatly strengthened my belief in this respiratory function of the vessels in the test. In the first place, a consideration of the course of the circulation in an Ascidian shows that some such arrangement would in all probability be very advantageous. When the heart contracts ventro-dorsally the test receives a supply of almost pure blood; but when, on the other hand, it contracts dorso-ventrally, the current flowing to the test is impure blood which has been returned from the viscera and is on its way to the branchial sac. Hence it is obvious that it would be directly beneficial to an Ascidian if its test could act even to a slight degree as an accessory respiratory organ by allowing the blood circulating in its superficial layers to be brought into such close relation with the external medium as to render possible a certain amount of oxydation. And it is not difficult to imagine the process by which a few simple blood cavities existing (as it would not be unnatural to

* *Loc. cit.*, p. 279.

suppose) in the deeper parts of the test might extend into the superficial layer of the organ and become branched and swollen at their end twigs in order that the somewhat impure blood circulating in the test might, as a consequence, receive a little additional aeration.

But it seems probable that the ancestral Ascidiæ Simplices had no blood spaces in their tests. In the "Haus" of the Appendiculariidæ there are none; and in *Clavelina*, which I regard as nearer to the ancestral Simple Ascidian than any other form known, there are no vessels except those of the stolon. In *Ciona*, again, which is certainly one of the most primitive of the Ascidiidæ, vessels are only present in the posterior part of the test, and doubtless represent the vessels of the stolon which existed in the Clavelinid ancestor, although the stolon itself is no longer present.

I believe then that the system of blood cavities in the test was originally merely an apparatus for the production of new individuals by gemmation, as we see it at the present time in the Clavelinidæ, and that when the power of reproducing in this manner, so as to form colonies, was lost by some ancestor of *Ciona*, some of the ectodermal processes, with their contained blood spaces, still developed to a certain extent in the region where the stolon had formerly been, and proved of some slight service by permitting a little aeration of the blood to be carried on through the thin superjacent layer of test. If this respiratory function once became established, even though merely exercised to a slight degree, it is easy to understand how the system of vessels would gradually become modified into the various arrangements seen in the Ascidiidæ, and then into the more remarkable developments found in *Culeolus* and in the Molgulidæ.

Turning now to the Compound Ascidians, we find ramifying through the common test, in which the various Ascidio-

zooids of a colony are imbedded, a system (Plate II, fig. 5) of anastomosing canals, containing blood, and having terminal enlargements which have been known since the days of Savigny as marginal tubes and marginal bodies, but are obviously the same thing as the "vessels" of the Simple Ascidians. In some forms they are but slightly developed, while in others they become a conspicuous feature in the colony. Lately I have been examining some of the "Challenger" Botryllidæ, in which, in some parts of the test, the system of vessels is even more extensively developed than in *Culeolus murrayi*, and the terminal knobs form a closely packed layer of thin walled vesicles just below the external surface.

It is difficult to understand the cause of such an arrangement if the system has not a respiratory function. If the vessels were developed merely in order to convey a blood supply to the test, we would expect to find them more regularly distributed over its entire extent, in place of which they are totally absent in some regions, and excessively developed in others; they are in the form of long narrow tubes in one layer and of large expanded vesicles in another. In *Ascidia translucida* * the vessels are well developed over the left side of the body, and are totally absent from the greater part of the right side. In some Botryllidæ (see Plate II, figs. 6 and 7) they are so numerous and large in certain parts of the colony, and so slightly developed, if present at all, in other regions of the test, that they are the cause of a good deal of the characteristic external appearance of the species. Such cases as these are inexplicable if we regard the system as forming merely an ordinary blood supply to the test, but can be readily understood if we look upon it as an apparatus assisting in the aeration of the blood.

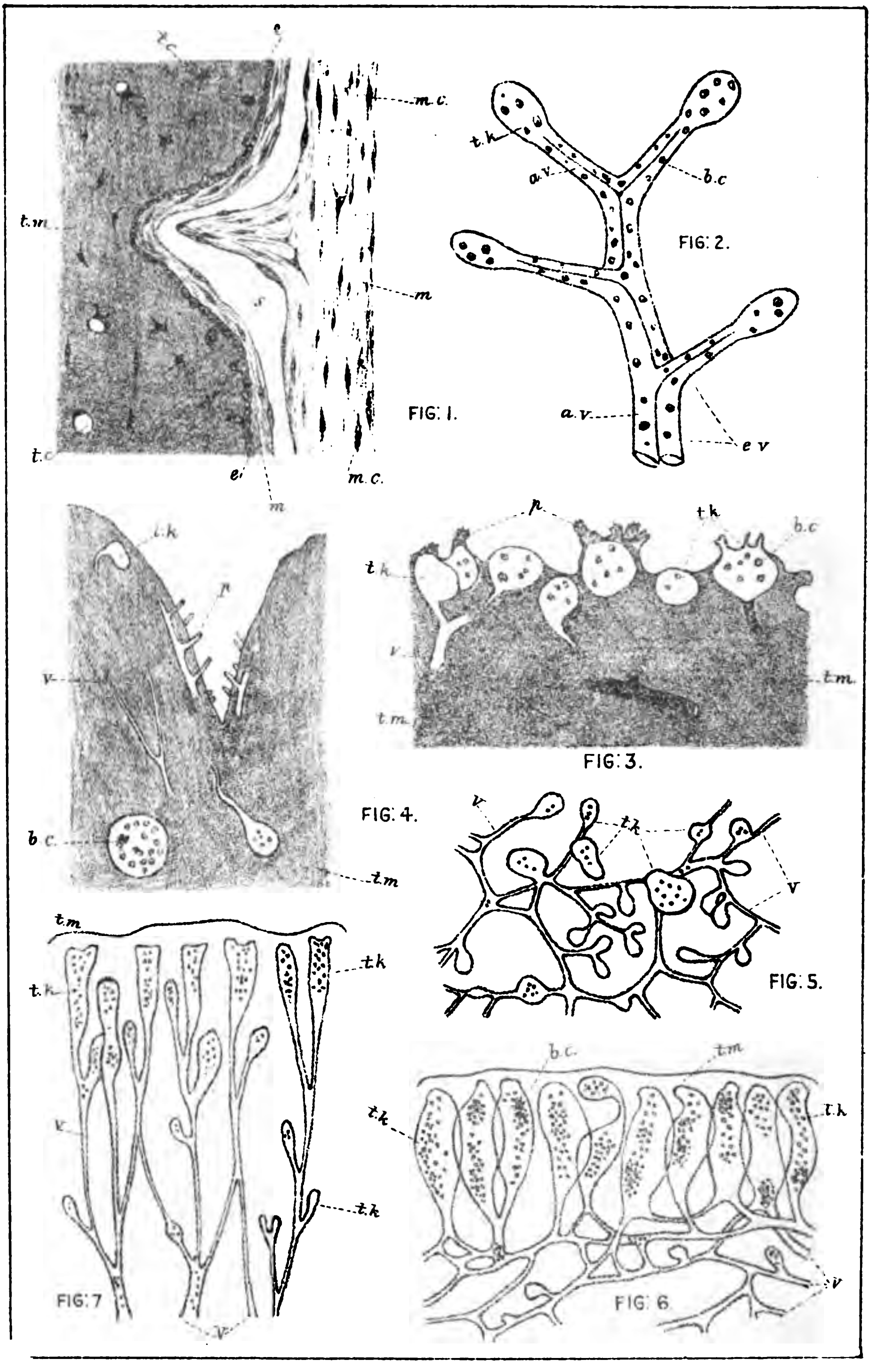
* See *Report upon "Challenger" Tunicata*, part I, plate xxxiii, figs. 1 and 2.

An additional argument in favour of my view as to the function of the vessels, has occurred to me while considering the variations of the branchial sac throughout the different groups of Tunicata. Amongst Simple Ascidians, the families Cynthiidæ and Molgulidæ, in which the branchial sac has its respiratory surface greatly increased by longitudinal folds, have the vessels in the test much less extensively developed than in the Ascidiidæ, where no large folds are present in the branchial sac. The fact that some Molgulidæ and Cynthiidæ have the vessels specially developed in long branched processes from the test, does not affect the argument, as in these cases a new function has been acquired, that of causing grains of sand and mud to adhere to the surface of the body. Then the genus *Culeolus*, in which the vessels are so well fitted to perform a respiratory function, although a member of the Cynthiidæ, has a very peculiar and imperfect form of branchial sac; and of the two species referred to above, *Culeolus murrayi*, which has the more imperfect branchial sac, has what seems a better arrangement of vessels in the test for respiratory purposes than that found in *Culeolus wyville-thomsoni*.

The Compound Ascidians which, as I have stated above, in many cases show the system of vessels in question in an enormously developed condition, have their branchial sacs decidedly smaller, simpler, and less efficient as organs of respiration than those of Simple Ascidians.

In conclusion, I believe that in most Ascidians the system of blood cavities in the test exercises more or less perfectly a respiratory function, and my chief arguments in favour of this view are:—1. The disposition of the tubes and cavities in the different regions and layers of the test, and the anatomical characters of the system. 2. The relation which exists in many groups of Ascidians between the branchial sac (the chief organ of respiration) and the

PLATE II.



VN ON STONE BY W.A. HERDMAN.

system under discussion; where the branchial sac is large and highly developed the vessels in the test are few and small, but where the branchial sac is small, simple and apparently inefficient, the vessels in the test are numerous, of large size, and disposed in such a manner as to suggest at once that they are concerned in the aeration of the blood.

Description of Plate II.

With the exception of Fig. 1, which is semi-diagrammatic, all the figures have been drawn on stone from the specimens as seen under Swift's 1-inch (about 50 diam.) or ¼-inch (about 300 diam.) objectives.

The following abbreviations have been used:—

a. v., afferent vessel of the test.
b. c., blood corpuscles.
e., ectoderm.
e. v., efferent vessel of the test.
m., mantle.
m. c., connective tissue cells of the mantle.
p., papilla on the surface of the test.
s., blood sinus in the mantle.
t. c., cells of the test.
t. k., terminal knobs of vessels of the test.
t. m., matrix of the test.
v., vessel of the test.

Fig. 1.—Semi-diagrammatic section through part of the mantle and test of a Simple Ascidian, showing the mode of formation of a vessel in the test. Magnified about 300 times. Partly after Hertwig.

Fig. 2.—Termination of a vessel from the test of *Ascidia depressa*. Magnified about 300 times.

Fig. 3.—Part of a section through the test of *Culeolus murrayi*, showing the respiratory apparatus at the outer surface. Magnified about 50 times.

Fig. 4.—Part of a section through the test of *Culeolus wyville-thomsoni*, showing the prolongation of the vessels in a groove. Magnified about 50 times.

Fig. 5.—Part of the system of vessels in the test of a species of *Botrylloides* as seen in a surface view of the test. Magnified about 50 times.

Fig. 6.—Part of the system of vessels in the test of a species of *Botryllus* from the Chausey Isles. Magnified about 50 times.

Fig. 7.—Part of the system of vessels in the test of a species of *Botryllus*, dredged in Loch Fyne. Magnified about 50 times.

In the last three figures only the outlines of the vessels are shown as the surrounding test matrix is very transparent.

TECHNICAL EDUCATION.

By FRED. W. EDWARDS.

The keen competition to which almost every branch of British industry is now exposed has rendered it a matter of imperative necessity that the education imparted in our elementary schools should no longer be confined to the usual literary subjects of book instruction, but that the children taught therein should be prepared in some way for a more enlightened knowledge of the science and mysteries of the crafts to which they will afterwards be apprenticed. This conviction has gradually worked itself into the public mind, and in 1881 induced the appointment of a Royal Commission, at the head of which was Mr., now Sir Bernhard Samuelson, Bart., "to inquire into the instruction of the industrial classes of certain foreign countries in technical and other subjects, for the purpose of comparison with that of the corresponding classes in this country, and into the influence of such instruction on manufacturing and other industries at home and abroad."

The gentlemen entrusted with this important inquiry were well fitted for their task, and the Report which they have now completed proves that they were worthy of the confidence reposed in them by Parliament. The object of this Paper is to bring this report under your special notice, and to supplement my remarks upon its general scope with such observations as a not inconsiderable experience has enabled me to make upon the general question of Technical Education.

A mere cursory glance through the report shows at once

that the Commissioners have made close and patient inquiries into all the details of the work imposed upon them, and that the information they have collected is presented in a form which makes it easily accessible. France, Switzerland, Germany, Austria, Italy and the Low Countries were severally visited; the various schools and educational institutions of not less than sixty-three towns and villages were inspected, while a special committee inquired into the home industries of the Black Forest, Thuringia and the Tyrol.

The existing facilities for technical instruction in our own country were also brought under their personal notice, and in this respect the Commissioners have furnished us with copious information, not only upon elementary and secondary education, but also about the numerous institutions which offer both theoretical and practical tuition in art and science.

Availing themselves of their opportunity, the Commissioners also visited industrial works and manufactories both at home and abroad, and further acquainted themselves with the character and operation of such Continental Industrial Societies as are established for the benefit of the working classes. The information which they thus acquired as to the influence of education upon the development of manufactures, and which they have embodied in their report, is of the utmost value.

In addition to all this, there is a special report upon agricultural education at home and abroad; a second upon technical and industrial education in Canada and the United States; a third upon the silk industry of Great Britain, and a scheme for technical education in Ireland; each report drawn up by a special expert.

The whole of this information and these special reports are supplemented by a bulk of evidence and written statements furnished by Government officers, secretaries and other officials of working-men's societies, employers of

labour, and those engaged in the work of primary, technical, scientific and art education.

From this mere outline, it will be perceived that the report is large, liberal, and comprehensive; while it is further enriched with many valuable suggestions and recommendations which may possibly initiate a new era of commercial prosperity in Great Britain. I may beg leave to return to these recommendations on a future occasion, but at present my attention shall be confined to the general scope of technical education abroad, and the conclusions which have forced themselves upon my mind after a perusal of this part of the report.

For the purpose of clearness, the Commissioners have arranged their information under these five heads:—

1. Evening technical schools, for the use of artizans.
2. Artizans' general technical schools, and apprenticeship schools.
3. Intermediate technical schools, available for foremen and departmental managers.
4. Professional schools and trade schools for women.
5. Higher technical schools, for managers and employers.

The general subjects taught at these various schools have been classified as follows:—

1. Building.
2. Engineering.
3. Mining.
4. Weaving.
5. Dyeing.
6. Industrial Art.

Evening Schools.

These institutions are mainly supported by the State or municipality wherein they are situated, and the instruction

given in them is generally gratuitous, or at a very nominal cost. They are, properly speaking, continuation or further progress schools, and are generally attended by those who pass out of a primary school at twelve years of age, and who either do not wish or cannot afford to enter a secondary school.

In certain districts of Germany, for instance, a youth who leaves the elementary school for labour is compelled to attend these schools until he is sixteen. Two objects are gained by this continuous education.

In the first place, an interest in the knowledge already gained is maintained at that critical moment when the boy would otherwise be thrown into the world, soon to forget much he had already learned. And, in the next place, special help is given to the apprentice or young workman at a time when he is often too ignorant to avail himself of the special technical instruction which is afterwards placed within his reach.

These continuation schools are to be found in all the principal cities of the Continent. Their distinguishing feature is the care and attention bestowed upon drawing in its relation to the present and future occupation of the student. This subject of drawing illustrates, perhaps, more than anything else the difference between our own educational system and that of the Continent. Continental education is consecutive; the elementary school leads to the workshop as well as the secondary school; the school and the workshop are thus in intimate connexion. Drawing is classed as a separate elementary subject, and it is taught in the elementary school with special reference to the workshop, and in such a manner as to lead the student up to the higher forms of technical instruction. The classes of the evening school have everywhere proved to be a valuable link in the chain of education abroad, they have exerted a great influ-

ence upon artistic industries, and as an example of their success it may be stated that in Paris alone there are sixty-five of these evening schools, with the large total of 3,334 students.

Apprenticeship Schools.

These are also municipal institutions, and where not free the fees are on a very light scale. The instruction imparted in them combines both theory and practice, and practice in the workshop accompanies theoretical instruction in the school. Such schools are very common in Germany, Prussia, and Austria. One of the best of these is situated at Iserlohn, in Westphalia, in the centre of a district abounding in ironworks and collieries. Handicraft teaching is here associated with instruction in industrial art, as applied to metal work. Every occupation in which metals are concerned, from puddling and ironfounding to engraving and etching, has its students, who are further taught to develop and make the most of the mineral resources of their district.

The influence of these apprentice schools has been marvellous. In some places entirely new industries have been created, in others old ones have been revived and extended. In the Black Forest, which is the seat of a great number of home industries, such as clock-making, wood-carving, straw-plaiting, and basket-weaving, the schools have given a great impetus to these trades, and materially improved the general welfare of numerous village communities, whose occupation was very precarious on account of their remoteness from the great centres of commerce.

Higher Grade Schools.

The most important institutions, however, for the training of skilled workmen are the higher grade technical

schools. In the evening class and apprenticeship school the ordinary artizan has every opportunity of making himself an intelligent workman, but if he possesses good abilities, and is inspired with an ambition to rise in his calling, the higher technical school is open to him for the instruction necessary to his advancement. The subjects embraced in the curriculum of these higher institutions are very numerous, but in each they are adapted, as far as possible, to the main object for which the institution was founded.

All of them, however, may be comprised under the three heads of general, special, and industrial art schools.

The general technical schools are of an elementary and secondary character.

In the former, workshop instruction is carried to a much more advanced stage than is possible or desirable in the lower schools, and the various departments are replete with models, apparatus, and specimens, for teaching the technology of the special trade of the district where each is situated.

The Commissioners say that this class of school is singularly wanting in our own country, and they can only point to Allen Glen's institution at Glasgow as an example in any way approaching to these higher elementary technical schools abroad.

The Secondary Technical Schools partake more of the character of colleges, and the majority of the students are those who aim at becoming managers and sub-managers, as those of the Elementary Schools are trained for the position of foremen and overlookers. The Firth College, at Sheffield, and University College, Nottingham, are fair examples of these institutions at home. Above these again is the Polytechnic School or Technical University, which is to be found in most of the large continental cities. Germany alone has twelve such institutions at the present time. The

cost of their erection and furnishing has been about three millions sterling, and the annual outlay for their maintenance is about £200,000. The origin and aim of these technical universities cannot be better described than in the words of the Commissioners, who say:—"The great impulse which was given to engineering and manufacturing some forty or fifty years ago, by the formation of railways, the establishment of factories throughout Europe, and the demand which arose for highly-skilled assistants, owing to the widespread introduction of the steam engine and other mechanical inventions depending upon it, gave rise in Germany and Switzerland to the creation of High Schools, in which the necessary scientific training, with its practical application, could be imparted, so that by these means a body of men might be educated in such a way as to make it possible for continental States to compete with the workshop trained engineers of England, the numerous universities of Germany not furnishing instruction of a sufficiently practical character."

This clear determination of our continental neighbours to challenge the supremacy of English workmanship was at once put into practice.

Immense blocks of buildings, similar in character and extent to the Central Institute lately erected at South Kensington, were built and maintained in the chief centres of industry. Workshops, laboratories, and museums, complete and costly, were provided, and the best instruction secured by the appointment of skilled teachers and professors of repute, tempted thither by liberal salaries. The fees for instruction were fixed on so low a scale that the schools were made available to all classes, irrespective of rank, trade, or profession. The Commissioners are filled with admiration at the results which this elaborate and widespread system of Technical Education has produced. Continental artizans

are remarkable for their intelligence; the masters and managers of large works are thoroughly acquainted with all the details of the special science which underlies their trade. They are familiar with every important discovery, and have not failed to utilize it as far as they are able, while by their knowledge of foreign languages they can obtain early information of the inventions and ideas of other countries.

The Commissioners conclude their remarks on these points by observing that, so far as Germany is concerned, the supply of technically-trained students is in excess of the demand for them in their own country. The consequence is that many of them come over to England and find ready employment with our leading manufacturers, especially in the larger chemical works.

The technical education provided in the higher grade schools, now described, is of a liberal and highly scientific character, but the details are practically worked out in the special schools, which form the second of the three classes into which these institutions may be divided. These special schools, as their name denotes, apply themselves to the development and improvement of particular trades; they are spread like network over France, Germany, and Austria, and to them must be mainly attributed the prosperity of continental manufactures during the last quarter of a century. So convinced are our foreign neighbours of the importance of these schools to the successful growth of their trade, that they willingly submit to the burden of their support. In Stuttgart, for example, £50,000 has been spent in the erection of the trade school. This institution, like many others of its class, is a free and municipally-supported school, and when we consider how heavily taxed the Germans are for civil and military purposes, it is incredible that they should be willing to impose upon themselves such additional burdens did they not feel that the increased outlay would

bring in more lucrative returns. The Municipal Professional School at Rouen, which may be taken as a type of the rest, will further illustrate this. The annual cost of the school to the town is £1,120, and the education is free. One hundred and forty students are in daily attendance; theoretical instruction occupies them from seven in the morning till six at night, three hours being allowed for recreation, and in the evening two hours are devoted to manual labour. The theoretical instruction is very practical in its character. Science is learned more from experiments in the laboratory than from text-books; mechanics are taught in the workshop, and the study of languages is set aside for that of pure and applied mathematics.

The practical instruction consists of working in wood and iron, the pupils are made to go through a gradual series of manipulations, and after passing through the various grades they go out as foremen, or proceed to the higher schools. It is through these trade schools that the children of artizans or small shopkeepers educated therein emerge from the narrow groove of their birth and surroundings, and strike out into the world, in which they are well qualified for the competition which awaits all who have to earn their own livelihood.

Weaving and Dyeing Schools.

The Weaving and Dyeing Schools of France and Germany have a special interest for us in the present unsatisfactory condition of our woollen industry. It will be remembered that it was the Flemings who came over to England centuries ago and taught us these useful arts, in which we rapidly excelled. It is a strange fact, but nevertheless true, that their kindred should in modern times have deprived us of our former ascendency, and transferred this superiority to its original home. The explanation is not

difficult to see in the light of the report before us. We there find that large sums of money have been, and are being, spent in the establishment of weaving and dyeing schools on the most approved scientific principles. At Roubaix, the French have erected one at a cost of £80,000; and the Germans, who already had an extensive school at Crefeld, have made considerable additions to it, and displayed an enthusiastic interest in its welfare, as much as £42,000 having been laid out in its extension. Another weaving school which may be mentioned is that which has been erected at Verviers, in Belgium, at a cost to the town of £20,000, and to which the inhabitants are now adding a school for the further progress of their textile industries, at an extra sum of £24,000.

Many other instances might be given of this general conviction in the minds of foreigners, that the trade school is imperatively essential to the success of their special occupations.

The general aim of these weaving schools is to give technical instruction in all the departments of textiles, not only of their manufacture, but of the commerce which distributes them. It is curious to note how sensitive and delicate is the life of an industry which is so largely dependent on the caprice of fashion. The prevalent but transient fancy of the world in combinations of colour and beauty of design must be caught up and rapidly reproduced by the loom, and this by such a process as will both compensate the manufacturer for any special outlay and meet exactly the popular taste and idea as regards quality and price.

The greater number of these weaving and dyeing schools are only departments of the general technical schools. Others, however, such as those I have referred to individually, are independent institutions, solely devoted to the

teaching of spinning, weaving, dyeing and designing, and are springing up in various parts of France, Belgium and Germany.

These special schools do not supersede the apprenticeship schools; they are, in reality, further progress schools, for providing the knowledge which otherwise could only be obtained in particular districts and works.

They present to the workmen or the manufacturer a complete synopsis of all the processes of his industry; while in the museums, which form a most important adjunct to the schools, there are displayed specimens of textile work from every known part of the world, in every stage and process of manufacture, from the raw material to the finished fabric.

The method of instruction in the dyeing schools must not be passed over without comment. In this department of the woollen trade the Germans and Swiss are considerably in advance of Englishmen. With the extension of science and art classes under the direction of the department at South Kensington, the Commissioners hope that this superiority will gradually disappear. But much remains to be done if this hope is to grow into assurance.

Continental supremacy in the art of dyeing is mainly due to the fact that the pupils in the trade schools abroad are well grounded in chemistry, so that they can use with intelligence the formulas laid down for the production of colour, and the receipts for weighing and mixing the ingredients required for specific patterns. Fully appreciating the influence which this knowledge of chemistry has had upon the art of continental dyeing, the Commissioners observe that "It is absolutely necessary, in this as in all other arts, that a secure foundation be laid; and just as a knowledge of art forms the basis of instruction for the designer, so a knowledge of chemistry is the true groundwork of the student of dyeing."

In illustration of this superiority of continental dyeing, I may refer you to the well-known fact that the woollen manufacturers of Bradford and the neighbourhood send annually many tons of their worsted yarns to be dyed in France before weaving them into cloth. It is also equally notorious that Saxony imports immense quantities of cotton yarns from Manchester and worsted yarns from Bradford, which she exports back again to these districts as fancy cloth goods, although there is the double cost of carriage to and fro, as well as a heavy import duty on the yarns when they enter Germany.

The Commissioners give other instances of the same character, all tending to shew that much of our trade which is now transferred abroad might be kept at home, if English workmen had placed within their reach the same opportunities as foreign artizans have for learning more thoroughly and continuously the art and science of their calling.

Industrial Art Schools.

The last division of the various kinds of higher grade institutions for technical education is that of the industrial art schools, which may be described as those in which it is shown how "art is the handmaid of industry." And a singularly efficient handmaid she has proved to be in Germany and Austria. In Berlin, Munich, Dresden and Vienna, art, in its application to a large number of industries, is taught on an extensive scale. Here, as elsewhere, the schools are State supported, and they present many features in common with our own art schools at South Kensington. But they are more lavishly provided than our great central institution in London, and are further advanced as regards design and its application to industry. The continental system, as far as Germany and Austria are concerned, tends to make the student an artist designer

rather than an artist painter; but, while he is distinctly taught to apply his art to industry, it must not be supposed that he is less highly trained or developes less talent than the one who turns his attention merely to painting and the fine arts. The early training of both is the same. Their studies are confined to drawing, modelling, and painting in monochrome, but when these elementary qualifications have been attained, the artist designer enters upon the special work for which he has already been prepared, and applies his powers of design to some specific industry. This may be called his stepping-out period, when he has the opportunity of displaying his genius, whether it be for striking originality of invention or purity of form. Like the manufacturer of silks and woollens, he must be prompt to meet every fickle demand of fashion, and adapt his art to gratify the passing caprice of the day. It is for this object that the German potters, with commercial forethought, send their sons and apprentices to model, paint, and fire ceramic vases at the Munich Industrial Art Schools. It is the secret of the success of that fancy textile work taught at Dresden, the colours and patterns of which are so tasteful and enduring as to command a large sale in the English markets. This is why the pupils at Nuremberg learn to model from the best floral examples of ornament, by the early Italian, Flemish, and Renaissance masters, why Vienna is celebrated for such high-class porcelain painting, why she excels in artistic metal chasing and working in brass and bronze, why Munich is so famous for its painting on glass, and why the makers of coloured glass there are so anxious to obtain the services of these artist designers in their works. This is enough to indicate how efficiently industrial art abroad has been utilized to secure commercial prosperity.

The Commissioners conclude this part of their report with the suggestion that a part of the great wealth of the

City Livery Companies could hardly be better employed than in the encouragement of talented designers, and rewarding their meritorious work. These great guilds will probably act upon this hint, since the Commissioners who were appointed to enquire into their constitution and resources practically recommend the same thing.

Having now presented a brief synopsis of the long and interesting account of Continental schools given by the Commissioners, I will conclude with a few observations which seem to me pertinent to the work of Technical Education.

The most striking feature to which the report bears witness is the extraordinary lavishness with which public money is spent abroad on the various departments of this great subject, when compared with the extent of our own grants for every kind of education. The question that will probably arise in many minds on this point, and one that will require a definite answer ere long, will be, how far are we prepared to follow this example, and by what method shall we proceed?

Another prominent characteristic which we may notice is — the great influence which the system of continental evening schools has had upon technical education abroad. They have established a connexion between the elementary and technical education of artizans such as does not exist in this country. When a boy has passed his standards in an English elementary school, his parents, as a rule, consider that his education is complete, and forthwith put him to the trade which offers the first opening for increasing the family exchequer. The youths of France and Germany, on the contrary, are taught to regard this primary stage as the commencement of their education. After passing through an elementary school, they are urged to go forward, and add to the knowledge they have already acquired. In some cases it

is a voluntary movement, in others a compulsory one. The continental boy at such a juncture has clear prospects before him. He can continue his general education in the evening classes, or begin to train himself in the apprenticeship schools. If his ambition seeks a higher sphere he can further improve himself in the higher grade schools, and if his means will allow, he can qualify himself for the highest positions, in the polytechnic school. The ladder of education, as it has been happily described by one of our most eminent scientists, is thus free and uninterrupted, from the lowest rung to the summit.

The only educational machinery in England which has been in any way analagous to the continental evening classes is that of our mechanics' institutions founded by Dr. Birkbeck in 1823. In their best days, however, they did little more than instruct our workmen in the veriest rudiments of knowledge during a few hours in the evening. The spread of elementary education, and particularly the Act of 1870, having removed the necessity for supplying primary instruction in these adult schools, a fitting opportunity is offered for transforming and adapting them to the same purposes as the technical schools of the Continent. They might be so arranged as to comprise within the same building evening classes for supplementing the elementary education already received, and apprenticeship schools for instruction in the special knowledge pertaining to the particular trades of each district.

It is pleasing to note that such a development as this has already begun.

At Huddersfield, technical schools have been erected at great cost, and the old Mechanics' Institute has been affiliated to them. In many towns it may be impossible at present to erect technical schools; but where mechanics' institutes are in operation, they might, by a very simple

extension of their classes, or by the erection of one or more additional departments, be readily converted into technical schools, and this without any serious outlay. A system of instruction could thus be inaugurated, which, as it grew, would before long force itself upon the attention of Government, and lead to the establishment of a general scheme similar to that which now provides for the elementary education of the country at large. Advancing now a step further, it is interesting to observe how earnestly several continental nations have vied with each other in the formation of the great polytechnic schools. It has been shown how complete is the course of instruction provided under these Governments, from the lowest elementary subjects to the highest branches of art and science.

Where the ordinary college fails or stops short, the technical university or polytechnic schools come in, and continue on the same practical lines the instruction of the lower grades. A direct consequence of this perfect organization is, that in the principal artistic industries, as well as in artistic ideas, our foreign neighbours are considerably in advance of us. It is singular that while we have accomplished more as regards art education than any other people during the last twenty years, we should have failed to utilize it as much as we might have done for the benefit of our industries. This leads me to another conclusion which is fairly justified by the evidence of the Commissioners. It is essential to the further progress of our trade that we should further develop the brain power of our operatives and artizans. We often boast of the value and extent of our mineral resources, and are satisfied that apart from the national character, they have been the main cause of our commercial prosperity. But these resources are constantly being drawn upon, and in the view of some pessimists their end is not far distant. In the face, then, of so much severe

foreign competition, does it not behove us to make the most of these resources while we have them, and turn them to more efficient use in our arts and manufactures? At present the brain-power of our workmen is not equal to this, nor do they receive sufficient intellectual sustenance to enable them to bear the strain of such an unequal competition. Darwin has told us of certain plants that not only entangle, but absorb and digest, live insects. When all that can be assimilated by these plants has been removed, the dry shell is left to be blown away. With a like capacity the continental artizan has succeeded, by the aid of superior technical instruction, in absorbing much higher forms of knowledge, and digesting more scientific food than our own countrymen of the same class. Our workmen have, in fact, been subsisting on the driest skins of knowledge, while the nutriment within the body has been extracted by their foreign competitors with stronger mental apparatus.

Our artizans need to be provided with a complete course of technical instruction, beginning with the elementary school, and continually progressing through the various stages enumerated in this paper. As it is, they pass the best portion of their lives without ever obtaining any real grasp of their craft. The philosopher-poet, Oliver Wendell Holmes, says that "at thirty we are all trying to cut our names in big letters upon the walls of this tenement of life, twenty years later we have carved it, or shut up our jack-knives." But the British workman has, in too many instances, never been taught how to open his jack-knife. Little wonder, then, that he has so seldom been able to cut these big letters for himself, or to leave behind any permanent impression to show what manner of man he was.

At one time almost the entire manufacturing trade of the world was in our hands, and foreign nations, cursed with perpetual warfare, had neither means nor opportunity for

developing their resources, or cultivating the arts of peace. But, while our monopoly of trade made us supine, and the absence of competition indifferent, foreigners soon began to perceive that if they were to have any share of the world's commerce, it must be obtained through the superior workmanship of their artizans. They commenced to build schools, and inaugurate extensive schemes of education, for the special benefit of their middle and lower classes. In the memorable Exhibition of 1851 they obtained much information from us, and copied and improved upon our machinery. Progressing continually from that time to the present, they now compete with us, not only in our home markets, but in those abroad, which were once exclusively our own. Imitation is the sincerest form of flattery. As we have taught them to excel, we may fairly take a lesson from them in turn, and by placing within the reach of our artizans the most efficient means of technical instruction, restore to our manufactures their former supremacy and renown.

A PHYLOGENETIC ARRANGEMENT OF ANIMALS.

By W. A. HERDMAN, D.Sc., F.L.S., F.R.S.E.,

PROFESSOR OF NATURAL HISTORY IN UNIVERSITY COLLEGE, LIVERPOOL.

Introduction.

During last session, Mr. Higgins asked me to draw up for him a Table showing, as far as possible, the natural relationships between the chief groups of Animals. This piece of work I very gladly undertook, as I had for several years been in the habit of using phylogenetic tables or diagrams of a few of the main groups of organisms in some of my lectures at University College, Liverpool; and I felt that it might be useful to combine and supplement these partial tables so as to form a general scheme showing a natural classification of animals. I accordingly prepared the accompanying table, which was lithographed and printed in June, 1884. A few copies, without any descriptive letterpress, were issued during the summer, along with Mr. Higgins' paper on "Museums of Natural History,"* but as the diagram is to a large extent new, and requires a full explanation, I have decided to lay it before this society, along with the necessary description.

It is obvious that such a table as this can only be in a limited sense original. It must agree more or less in its main lines, and even in some cases in its details, with various other phylogenetic tables; and where it differs from these it does so usually because of some comparatively recent discovery, and ought therefore to express the results of the latest investigators in each group of animals. The views of

* *Proc. Lit. and Phil. Soc. of Liverpool*, vol. xxxviii; p. 183.

the latest authorities, so far as they have commended themselves to me, have been adopted, and I have tried to make the scheme as nearly as possible a diagrammatic summary of the present position of our knowledge as to classification. The various books and memoirs which I have made use of in preparing the table will be referred to in footnotes, but I may make special mention here of the knowledge I have gained, in regard to the relations of nearly every group of animals, from that invaluable work, Balfour's *Treatise on Comparative Embryology*.

Description of the Table.

One of the features of my table is that all the groups are represented as being at the *ends* of lines or branches. In some previously published phylogenetic schemes, notably in those of Professor Haeckel,* many groups still living are placed upon the course of lines leading to higher groups. This to my mind indicates, first, that the lower groups are extinct, and secondly, that they are the direct ancestors of the higher forms, both of which would be erroneous conclusions. Consequently, I have in no case allowed the line representing the evolution of one group to pass through another group. Even in the case of *Amœba,* I have preferred to place those species now existing upon a short side branch, rather than upon the main stem formed by the common ancestors of the Foraminifera, Radiolaria, and higher forms.

The lowest organisms are at the foot of the table, the highest at the top; and the line traced from the very base to any name indicates the probable course of the evolution of that group of animals. If a line stretches upwards it shows an advance in structure; if it is nearly horizontal it

* Haeckel, *Anthropogenie*, etc., Leipzig, 1877; *Natürliche Schöpfungsgeschichte*, Berlin, 1879; *Studien zur Gastræa-theorie*, Jena, 1877.

means that little or no upward evolution has taken place; if it slopes downwards,* that indicates degeneration or degradation. †

I have tried roughly (it can only be done very roughly) to represent by the proportional lengths and angles of the various lines the amount and the nature of the evolution which has taken place. The difficulty in effecting this has been increased by the necessity of showing in one plane a system of branching which really extends through all directions of space.‡

At the base of the table all animals and plants are represented as derived from a single Protamœba-like form § of extreme simplicity. In some former schemes,|| the Protozoa and Protophyta are represented as arising by a number of distinct roots. I have nothing to urge against such a plan, except that it seems a gratuitous assumption. If all the Protista can be satisfactorily derived from a single ancestral form composed of undifferentiated protoplasm, there is no necessity for assuming that the different groups of Protozoa and Protophyta originated from independent sources. When once a single piece of living protoplasm had, under certain

* Margo (*Mathematische und Naturwissenschaftliche Berichte aus Ungarn*, Bd. i, p. 234; translated in *Ann. and Mag. Nat. Hist.*, May, 1884), recognises Degeneration, but represents degenerate groups in his table by lines stretching upwards. There are many parts of Dr. Margo's table with which I cannot agree.

† See Ray Lankester's "Degeneration," *Nature* Series, 1880.

‡ I have for some time past intended to construct an actual "tree" or system of classification in three dimensions, but I see that Professor Haddon has recently made a model of this nature (*Proc. Roy. Dublin Soc.*, 1884, p. 200).

§ Some such undifferentiated organism as *Protamœba primitiva* (see Haeckel, *Monographie der Moneren*, Jena, 1868; and *Studien über Moneren*, Leipzig, 1870, p. 43.

|| See the "Stammbaum," given by Professor G. V. Koch in his *Grundriss der Zoologie*, and reproduced in Mr. Higgins' *Lines of Animal Life*, Liverpool, 1877.

conditions of which we are absolutely ignorant, become evolved, there would be no need of any further points of origin.

The various lines at the base of the Protista in some schemes, which lead to no existing groups, but represent modifications which have died out, I prefer to place as short side branches from the main stem between *Protamœba* and the point of origin of the Myxomycetes. They might be indefinitely multiplied; and this remark holds good for all parts of the table. It would have been more natural and complete if every line and branch had been shown bristling with short twigs, extending in all directions, and of different lengths, and representing modifications or variations which have died out. These have been omitted because they would have added greatly to the complication, and can readily be imagined. The existing Monera might also be shown as short lines stretching outwards and upwards from points on the main stem between *Protamœba* and *Protomyxa*.

I have made the plants diverge from these lowest organisms at the top of the series of Monera, and I have placed *Protomyxa* close to this point, on account of the similarities it exhibits to the Myxomycetes.* The long line running to the right from the top of the Monera, and which represents the series of Myxomycetes, is shown as horizontal, not because there is no upward evolution in the organisms it indicates, but simply in order to emphasise the great divergence from the main stem of the animals. The Myxomycetes are represented as leading to the Protophyta, from which the detailed classification of the Metaphyta might be continued onwards to the right. In making a phylogenetic table of plants, it would be better to place the series of Myxomycetes more in a straight line with the Monera; and in a scheme including all organisms, the main stems of the

* Haeckel, *Studien über Moneren*, pp. 10, 67, &c. Leipzig, 1870.

plants and the animals should be made to diverge at nearly equal angles from a point close to *Protomyxa.*

The great group of the Infusoria is shown as originating at the top of the Monera, and the earliest forms were probably ancestral Monads resembling the mastigopod stage* in the life history of *Protomyxa.* Several aberrant groups, such as some of the Flagellata, the Catallacta, and *Noctiluca* and allied forms, probably diverged from the main line of the lower Infusoria; and the striking resemblances which some of the Cilioflagellata, for example, show to some of the lower plants is not surprising when we consider their close relationship; the common Protomyxa-like ancestor is not very far removed from either of them.

Passing up to the higher Infusoria—the Ciliata—the Holotricha may be regarded as the division which is most nearly in the direct line of development; while the Hypotricha, the Heterotricha and the Peritricha are more or less divergent groups which may be conveniently represented as side branches from an ancestor of the Holotricha. The Peritricha are probably further removed from the main line than any of the others. The small group of Opalinida are best considered as having degenerated from the Holotricha. The Suctoria or Tentaculifera I have placed on a long side branch which arises rather far back on the main stem, distinctly below the Ciliata, and does not rise much in its course.†

Advancing along the main stem stretching upward from the Monera, we come to the common ancestors of the Foraminifera and Radiolaria, and near to this point must be

* It has been pointed out by Perrier (*Colonies Animales*, p. 126), and later by Geddes (*Proc. Roy. Soc. Edin.*, 1883-84, p. 266), that a number of the Protista pass through (1) Amœboid, (2) Encysted, and (3) Flagellate stages in their life history.

† Saville Kent (see *Manual of the Infusoria*, vol. i, p. 37, etc.) traces the origin of the Tentaculifera back to the main line, near *Amœba*.

placed *Amœba* on a short side branch. From an Amœba-like form on the main stem the line of the Foraminifera has diverged through the ancestral Lobosa in the one direction, while from much the same point the line of the Radiolaria has passed in another direction through the primitive Heliozoa.

In arranging the groups of the Radiolaria I have followed Haeckel.* The present Heliozoa are seen springing from the main branch distinctly below all the true Radiolaria, while the next twig given off leads to the Acantharia, the supposed ancestral form of which was probably closely related to the primitive Heliozoa. The three remaining groups are shown as diverging from a point above the origin of the Acantharia in different directions, and the Phæodaria attain a somewhat higher level of differentiation than any of the other Radiolaria.

The Gregarinida I have placed on a long branch springing from the main stem close to the highest Monera and reaching a little above the level of *Amœba*. The length of the line shows the considerable amount of differentiation attained by the group and its somewhat isolated position, while its point of origin indicates the relationship which probably exists between the Gregarinida and the Monera.

The dotted line stretching downwards from the base of the Metazoa may serve to recall the possibility that the Gregarinida are a much degraded offshoot from some group of Gastrea-like organisms.

Above *Amœba* the main line leading up to higher organisms must have passed through various unknown forms of compound or colonial Protozoa, forming transition stages between the known Protozoa and the lowest Metazoa. These unknown transition forms by which a unicellular passed into

* *Sitzungsberichte der Jenaischen Gesellschaft für Med. und Wissenschaft*, Feb. 16th, 1883.

a multicellular body are probably represented by some of the earliest stages in the development of higher forms.

Near the base of the Metazoa a number of lines diverge from a point which was probably occupied by a simple ancestral Metazoon, more or less resembling the embryonic Planula and Gastrula stages. This hypothetical form may be Haeckel's Gastrea * or Lankester's Planula † or Bütschli's Placula. ‡ From this point (Gastrea in the table) I have shown a line sloping downwards towards the Dicyemida and the Orthonectida. This indicates that these two groups, which may be distinguished as Mesozoa, § are to be regarded as degenerate offshoots from the Metazoa.|| The great groups of the Sponges or Porifera and the Cœlenterata probably diverged from the main stem about the same point,¶ or possibly travelled for a short distance along the same branch representing a few common ancestors after they had left the main stem. The Physemaria ** I have placed upon a separate branch close to the base of the Porifera. It is probable however, that they are really Protozoa, and in that case may be regarded as aberrant Foraminifera.††

The calcareous Sponges are placed as the earliest branch given off from the primitive Porifera, while the Myxospongiæ form a slightly degenerate group from a point rather further

* *Studien zur Gastræa-theorie*, Jena, 1877.

† *Notes on Embryology and Classification*, London, 1877.

‡ *Morphologisches Jahrbuch*, Bd. ix, p. 415 (1884).

§ Van Beneden, *Recherches sur les Dicyemides*, Bull. Acad. Roy. Belgique, 1876.

|| Margo (*loc. cit.*) regards them as probably degraded forms of Platyelmia. I think it better to consider them as derived from a still lower point on the main stem.

¶ Possibly the Porifera arose from the Protozoa independently of the other Metazoa. (See Balfour, *loc. cit.*, v. ii, p. 285.; and Sollas, *Quart. Jour. Mic. Sc.*, vol. xxiv, p. 608. 1884.)

** Haeckel, *Studien zur Gastræa-theorie, III Die Physemarien;* and *Sitzungsber. Jenaische Gesell. f. Med. u. Naturwiss.* 1888, p. 84.

†† See Ray Lankester, *Quart. Jour. Mic. Sc.*, v. xix, p. 476 (1879).

on. The great group of the Fibrospongiæ have diverged with a considerable amount of differentiation from a still more advanced point, leaving the Hexactinellidæ as the end of the Porifera branch and furthest from the main stem.

The ancestral Cœlenterata are represented as dividing first into two groups,* the primitive Hydromedusæ and Scyphomedusæ. From the first of these, branches diverged which have formed the Trachylarida, Calyptoblastea, Gymnoblastea, Hydrocorallina, and Siphonophora; while the Ctenophora † may be placed on a long branch directed upwards from near the common base of the Hydrocorallina, Gymnoblastea and Siphonophora, and extending considerably above any of these groups. The Trachylarida is shown dividing into two twigs, which represent the Trachomedusæ and the Narcomedusæ. The other branches are also subdivided. Possibly the Siphonophora are as Haeckel suggests polyphyletic (see *Das System der Medusen*, Jena, 1879).

The second main branch of the Cœlenterata is shown as dividing into the ancestral Scyphomedusæ, which, following Haeckel,* I have divided into Peromedusæ, Lucernarida, Discomedusæ § and Cubomedusæ, and the primitive Actinozoa, which probably went through a considerable number of stages before the ancestral Zoantharia split off from the ancestral Alcyonaria.

The Antipatharia have been placed as a side branch from the Zoantharia close to their origin, and extending in the direction of the Alcyonaria. The Zoantharia is shown as giving off further up the Actiniaria or Malacodermata, and

* Haeckel's Hydropolypi and Scyphopolypi. (See Report on "Challenger" *Deep Sea Medusæ, Introduction*, p. xi.)

† See Haeckel, *Sitzungsber. Jenaische Gesellsch.*, 1878.

‡ "Challenger" *Zoological Reports*, vol. iv, *Deep Sea Medusæ*, Introduction, p. xiii.

§ The Discomedusæ may be divided into the Cannostomæ, the Semostomæ, and the Rhizostomæ.

then ending by splitting up into the various groups of Madreporaria.

The Alcyonaria is represented as terminating in two unnamed branches directed nearly horizontally to the right. These indicate such unmodified representatives of the Proto-Alcyonaria as the genera *Monoxenia*, *Haimea*, and *Hartea*. From close to this point are given off:—first, a branch leading to the Tubiporidæ through such forms as *Clavularia* and *Sarcodictyon;* and secondly, the common stem from which spring the Helioporidæ, the Alcyonidæ, the Gorgonidæ, and the Pennatulidæ. These four groups are differentiated in different directions, and are none of them very closely related to the Tubiporidæ, which seems to have arisen independently from the Proto-Alcyonaria.*

Returning to the main stem above Gastrea, we find it passing up to that intensely interesting region the origin of the various groups of lower Vermes. From this it may be traced upwards through the starting-points of all the great groups of higher animals, the Mollusca and the Chordata, the Crustacea and the Tracheata, to its termination in the Polychæta—the highest Vermes. From Gastrea to the base of Polychæta then, the main axis may be considered as consisting of a series of ancestral worm-like forms, extending from the most primitive to the immediate progenitors of the higher Annelids.

The lower Vermes, usually united under the term Platyelmia, are shown as springing from the main stem by a common root from which the group of the Cestoda is given off. This is represented as a long line to indicate considerable divergence, and it slopes downwards to show that the group is probably a degenerate one. The Platyelmian †

* See Hickson, *Phil. Trans.*, Part III, 1883, p. 700.

† I regard these forms as more or less degenerate, and as having no direct connection with the Cœlenterata, such as is advocated by Lang

branch is then continued onwards towards the ancestral Turbellarians, and finally terminates in the Dendrocœla. The Rhabdocœla diverge from the ancestors of the Dendrocœla as a slightly degenerate group, while the Acœla are represented as a much more degenerate branch arising further back. The Trematodes are shown as a degenerate group of the Dendrocœla extending downwards towards the Cestoda. The Nemertida is the highest Platyelmian group. It is represented as springing rather far back from the ancestral Turbellarians, and extending upwards for a considerable distance.

The points of origin of the Mollusca and of the far back ancestors of the Vertebrata from the Vermes, were probably close together and above the origin of the Platyelmia.

In the arrangement of the great branch representing the phylum Mollusca I have followed mainly Ray Lankester's classification.* Probably the nearest forms we know to the primitive Mollusca are those composing the group Isopleura, but even these are very considerably differentiated. To express this, a long line has been left between the origin of the Molluscan branch and the first point of division into the ancestral forms of the existing groups of the Mollusca. At this point, where the Lamellibranchiata are seen to diverge from the Cephalophora, the Isopleura are placed upon a short side branch between the primitive Molluscs and the ancestral Cephalophora.

Taking the branch of the Lamellibranchs first, we find that the axis terminates in the Integropalliate Isomya, while the Sinupalliate forms are represented by an offshoot upwards. The Heteromya have branched off from the

(*Mittheil. Zool. Stat. Neapel*, Bd. iii, p. 187, 1882, and *Fauna und Flora des Golfes von Neapel*, XI. *Monographie: Die Polycladen.* p. 645, 1884).

* See especially his admirable article "Mollusca" in *Ency. Brit.*, 9th edition, vol. xvi, p. 632.

Isomya, while the Monomya may be regarded as a degenerate group of the Heteromya.

The Scaphopoda are an aberrant group derived from the primitive Cephalophorous Molluscs, and more modified than the Isopleura.

The main branch of the Cephalophora splits into two great divisions which lead, the one to the Gastropoda, the other to the Cephalopoda. The first of these probably branched into two series of ancestral Gastropods, corresponding to the existing Euthyneura and Streptoneura. The Heteropoda may be regarded as a highly modified offshoot from the primitive Streptoneura, the remainder of which have become evolved into the numerous groups of typical Gastropodous Molluscs, which may be arranged under the Zygobranchiata and Azygobranchiata.

The Pulmonata form a highly modified side branch from the early Euthyneura, which later on split up into the ancestors of the Tectibranchs and the Nudibranchs.

Turning to the Cephalopoda, we find that at an early period the primitive Pteropoda must have diverged, while later on the branch divided into the Tetrabranchiata, and the early Dibranchiata which are shown as occupying a line of considerable length to indicate the extensive modifications the group has undergone during its evolution. This, the highest point in the Mollusca is, as may be seen in the table, very far above the point of origin of the phylum from the Vermes, and this indicates the great range of modification which is found in the Mollusca.

The Echinodermata I have represented as springing, along with the Enteropneusta and the early Chordata, by a common root from the Vermes, close to the point of origin of the primitive Mollusca. This branch is the largest and most important in the table. It probably very soon broke up into two series of ancestral forms (1), those which were

destined to lead upwards to the Vertebrata, and to which we shall return later on, and (2), the common ancestors of the Enteropneusta and Echinodermata. This latter series is now represented by *Balanoglossus*, and may be regarded as the termination of a branch having as lateral offshoots the Echinodermata on the one hand, and the Proto-Chordata on the other.

Early in the history of the Echinoderm phylum it is probable that the ancestors of the Holothuroidea and the Echinoidea branched off together from the main axis, and then later on divided into two distinct groups, each of which became considerably modified during its evolution. The Crinoids may be regarded as being nearer to the direct line of evolution of the phylum than any of the other groups, while the Blastoidea and Cystoidea form neighbouring side branches. The Ophiuroidea and the Asteroidea are more divergent, and probably the primitive Asteroidea split off first from the main axis, so that the Ophiuroids and Crinoids have had a rather longer common ancestry.

Returning to the main stem of the Table, we find a number of comparatively small groups, lying between the primitive Echinoderms and the higher worms, which are probably all derived from side branches given off from what may be called the middle third of the vermean axis—the lower third being the region below the point of origin of the Mollusca, and the upper third above the origin of the Arthropoda. These small groups are all more or less aberrant, and some of them are certainly degraded.

The Nematelmian worms are represented by a branch extending upwards to the right, above the common origin of the Chordata and Echinodermata. It ends in the Nematoda, while the Acanthocephala are shown as a degraded group sloping downwards from near the base of the branch.

The Gephyrea are probably an offshoot from the main stem not far from the point of origin of the Nematelmia.

The Brachiopoda and the Polyzoa are probably both degenerate groups belonging to this region of the Vermes. In the latter the Entoproctous forms are the most primitive, while the Ectoprocta have diverged more from the common ancestor.

The Chætognatha and the Rotifera are groups of somewhat doubtful affinities which are best placed in this part of the vermean series close to the origin of the Arthropoda. The Rotifera are certainly degraded forms.

We now come to the point where I show the two great Arthropodan series, the Crustacea and the Tracheata, diverging from the base of the higher worms at or about the same point. It is probable that these two great groups did not arise together but were evolved independently, and therefore, having no common ancestors nearer than the Vermes, must have acquired separately such Arthropodan characteristics as they possess in common.*

We shall take the Crustacea first. Here we find a long branch diverging to the right and terminating in the Phyllopoda, which are probably the direct descendants of the primitive Crustaceans.† The Cladocera are the most closely related group to the Phyllopoda, while the Ostracoda, Cirripedia, and Copepoda are more distant and more divergent series which have probably branched off from the Proto-Phyllopods in the order shown in the table. Some of the Cirripedia and Copepoda are certainly degenerate forms. The higher Crustacea have arisen from the main axis below the point of divergence of the Phyllopoda and Cladocera, and the Nebaliadæ are probably the nearest forms we know to the primitive Malacostraca. The Edriophthalmata must have sprung from near this point, and after a certain amount of

* See Balfour *Comp. Embryol.*, vol. i, p. 451. † *Ibid*, vol. i, p. 418.

divergence, they broke up into the sections now existing. The Stomatopoda and Cumacea may be represented as short lateral branches from the main stem of the Podophthalmata, which finally splits into the Schizopoda and the Decapoda. The latter, after some further evolution, become broken up into the Macrura, the Anomura, and the Brachyura, thus completing the Crustacean series.

The Onychophora (*Peripatus*) is the nearest group known to the first Tracheata which were evolved from the Vermes, but is probably somewhat degenerated, and is, therefore, best represented as a short branch sloping downwards from the main axis of the Proto-Tracheata.* This axis I have made to end in the Myriapoda, while the rest of the Tracheata are placed upon a divergent branch leading up to the base of the Arachnida and Insecta. Near to the ancestral Arachnids must be placed a few aberrant groups with somewhat doubtful affinities. Of these the most distinct is the Pantopoda or Pycnogonida,† a class not very closely related to any of the neighbouring groups. The Tardigrada and the Pentastomida are more closely allied to the lower Arachnids than to the Insects. The main branch of the Arachnida gives off the Poecilopoda,‡ with its ancestral sub-group, the Eurypterida, and, somewhere in the same region, the Trilobita, and is then continued up to end in the Acarida, the Arthrogastra, and the Araneina. Of these the Arthrogastra is nearest to the primitive Arachnid, while the Acarida § and the Araneina are rather more modified.

The Class Insecta, or Hexapoda, is very much more extensive than the Arachnida, and some of its sections attain

* See Balfour *Comp. Embryol.*, vol. i, p. 451.

† Hoek, "Challenger" *Zoological Reports*, vol. iii, "Pycnogonida," p. 145.

‡ Ray Lankester, "Limulus an Arachnid," *Quart. Jour. Mic. Sc.*, vol. xxi, Nos. lxxxiii and lxxxiv (1881).

§ Probably the Acarida should be regarded as degenerate.

a higher level of organisation—probably the highest point among Invertebrates. Still the range of modification is not great, and this part of the diagram requires little explanation. The Aptera (including the Thysanura and the Collembola) are decidedly the lowest forms, but are to be regarded as degraded. Among the remaining orders, the Orthoptera and their allies the Neuroptera, the Pseudo-Neuroptera, and the Dermatoptera (forming altogether Packard's Phyloptera*), show the least modification, and are probably the nearest to the primitive Insects. Next come the Hemiptera, and then the Diptera, while the Lepidoptera, the Coleoptera, and the Hymenoptera are all considerably modified and divergent groups. The Coleoptera were probably derived from the Hemiptera.† The Hymenoptera may be regarded as the highest forms.

Returning once more to the vermean axis, we must examine the upper third, the region above the origin of the Arthropoda. Near this point, and distinctly below the Annelides, may be placed as a side branch the Discophora or Hirudinea. On the other hand, this group may have to be placed lower down, on the Platyelmian branch, when fuller knowledge as to its affinities is acquired.‡ The rest of this region is composed of the Chætopoda. From the ancestral forms, the Oligochæta probably diverged in one direction and the small group of Achæta (*Polygordius*) in another. The Oligochæta afterwards gave off the Limicola as a lateral shoot. A small and curious group, the Myzostomida, is probably a degenerate branch from near this point.§ The vermean axis terminates by branching out into

* *Ann. Mag. Nat. Hist.*, vol. xii, p. 146 (1883).

† See Packard, *Guide to the Study of Insects*, p. 105. New York, 1876.

‡ On this point see Bourne, *Quart. Journ. Mic. Sc.*, vol. xxiv, No. xcv, p. 493 (1884).

§ See Beard, *Mitth. Zool. Stat. Neap.*, vol. v, p. 544, and also L. von Graff, *Report upon the Myzostomida* ("Challenger" *Reports*, vol. x, part

the numerous groups of Polychæta or true Annelides now existing. These are, therefore, the highest members of the large and heterogeneous phylum Vermes.

There remains now only the great and important phylum Chordata, which contains the whole series of vertebrate animals. The ancestral Chordata, as we have already seen, arose from the main axis of the Vermes rather low down,* and probably along with the primitive Echinodermata and Enteropneusta, from which, however, they must soon have diverged.

The lowest forms which we know of the Chordata are the Urochorda or Tunicata, but they are certainly a degenerate group which diverged from an ancestral Chordate more or less resembling *Appendicularia*, or, better still, the tailed larval Ascidian. Between such a form as this, however, and the primitive Chordate which diverged from the line of the Enteropneusta, there must be a vast difference, and the forms bridging over this gap are represented in the table by the long line extending upwards from the Enteropneusta to the base of the Tunicata, and corresponding to the Proto-Chordata of Balfour's diagram.† The Cephalochorda (*Amphioxus*) are also degenerate, and probably diverged from the main line of the Chordata near the point of origin of the Urochorda.

xxvii, 1884). From the adult anatomy, Graff considers the Myzostomida as being allied to the Tardigrada.

* There is still very great uncertainty as to where exactly amongst the lower Vermes this point is to be looked for. According to Hubrecht (*Quart. Jour. Mic. Sc.*, vol. xxiii, p. 349), and others, there is probably a closer relationship between the Proto-Chordata and the Nemertida than my table shows. On the other hand, Semper and others consider that the Chordata are derived from some group of the Annelida. I prefer to regard them as having arisen from a more generalised form than either the Nemerteans or the Annelida. Their point of origin was certainly far back (see Sedgwick, *Quart. Journ. Mic. Sc.*, vol. xxiv, No. xciii, p. 72, 1884).

† *Comparative Embryology*, vol. ii, p. 271.

The first group we come to in ascending toward the primitive Vertebrata is the Cyclostomata. This has also degenerated, but from a point rather further up and nearer to the true Fishes. At about this point the ancestors of all the higher forms must have, for the first time, acquired true jaws, and may be called Proto-Gnathostomata. The Holocephali and the Elasmobranchii arose together from the main stem of the Proto-Gnathostomata, but soon separated, the Holocephali becoming more highly differentiated than the Elasmobranchs. Further on the point of origin of the remaining groups of Fishes is discovered. The Ganoidei and Teleostei arose together, and probably have had a long common ancestry, the Proto-Ganoidei of Balfour,* and Pneumatocœla of Bridge.† The Teleostei are the most highly differentiated group of Fishes. The Dipnoi I have placed on a separate branch extending upwards from the point of origin of the higher Fishes (Euichthyes), and therefore between the Fishes and the ancestral Amphibians.

Considerably above the Dipnoi, the Amphibia and the Labyrinthodontia are given off together from the Proto-Pentadactyloidei (the common ancestors of Amphibia and Amniota) as a lateral branch, which diverges at its upper end into the different groups of Amphibians. A little above this point, the axis of the Vertebrata divides into two great series, the ancestral Sauropsida and the ancestral Mammalia. Just below this point of divergence, where the hypothetical forms may be called Proto-Amniota, I place the Ichthyosauria and the Plesiosauria as independent offshoots between the ancestral Amphibia and Reptilia. They may possibly have arisen a little further back, from the Proto-Pentadactyloidei.

I have represented the primitive Sauropsida as splitting into two groups, the one of which includes the Crocodilia, the

* Balfour, *loc. cit.*, p. 272. † Bridge, *Phil. Trans.*, 1878, Part ii.

Ornithoscelida and the Aves, while the other comprises the remaining Reptiles. The last group must be regarded as the more direct continuation of the primitive Sauropsida, and it terminates in the Lacertilia. From the base of the Lizards the Ophidia diverge as a degenerate but allied group. The Pterosauria branch off from the Lacertilian stem further back, and the Chelonia and Dicynodontia still earlier and not far above the point where the primitive Sauropsida branched. The Chelonia and Dicynodontia probably diverged from much the same point, or may even have had a common ancestry.

The second branch of the Sauropsida leads upwards to the Ornithoscelida, the Crocodilia being given off as a side branch in the direction of the other Reptiles. The Aves are shown as springing from the Ornithoscelida, and becoming differentiated into a number of groups. They extend considerably above the other Sauropsida.

The primitive Mammalia * stretch upwards from the base of the Sauropsida, and are continued as the line leading through the lower to the higher mammals. This axis gives off branches leading to four groups—the Monotremata, the Marsupialia, the Edentata, and the Sirenia. Of these, the Monotremes are very distinctly the lowest, and are probably the representatives of an early group of mammals to which Huxley has given the name Prototheria.† The Marsupials similarly represent a second distinct branch of early date—Huxley's Metatheria, and have probably risen considerably from their point of origin, and have become evolved into several distinct groups.

* This arrangement reconciles Caldwell's recent discovery (see *Nature*, vol. xxx, p. 577, 1884)—if we suppose that in the Proto-Amniota from which the Mammalia and the Sauropsida diverged there was a large amount of food-yolk in the ovum—with Huxley's demonstration of the Amphibian characteristics of the Mammalia (*Proc. Roy. Soc.*, vol. xxviii, p. 395, 1879).

† Huxley, *Proc. Zool. Soc., Lond.*, 1880, p. 649.

In the evolution of the Eutheria, the remaining mammals, the Edentata were probably given off first, and have degenerated. They probably divided at an early period into several distinct branches. The Sirenia are also degenerate, but arise from a higher source. The axis above this point splits into two. We shall first follow the lower or lefthand branch, which leads upwards to the primitive Ungulata. The Cetacea form a divergent somewhat degenerate group, springing from near the base of this line. Considerably further up we find the Rodentia, the Proboscidea, and the Hyracoidea given off as lateral branches.* The first and the most important of these is that representing the Rodentia. It rises to a considerable height, and is evolved into several branches. The Proboscidea and the Hyracoidea are shown as arising close together from the primitive Ungulata, but diverging in different directions. The Ungulata split into two sections, each of which has several divisions.

The second main branch of the higher Mammalia divides very soon into the ancestral forms of two groups. The first becomes evolved into the Insectivora, the Cheiroptera, and the Carnivora, while the second is the origin of the Primates. The Cheiroptera and the Insectivora are shown as arising not far from one another from below the base of the Carnivora. They extend upwards, and the Cheiroptera have undergone considerable modification—possibly they arose not independently but from an early branch of the Insectivora. Probably the Insectivora, which are in some respects very archaic, represent more nearly than any other existing forms the primitive Eutherian Mammal from which all the groups above the Sirenia diverged. The primitive Carnivora must have split into two series—the Carnivora proper (or Fissi-

* See Flower's article "Mammalia," in *Encycl. Brit.*, 9th edition, vol. xv, p. 372.

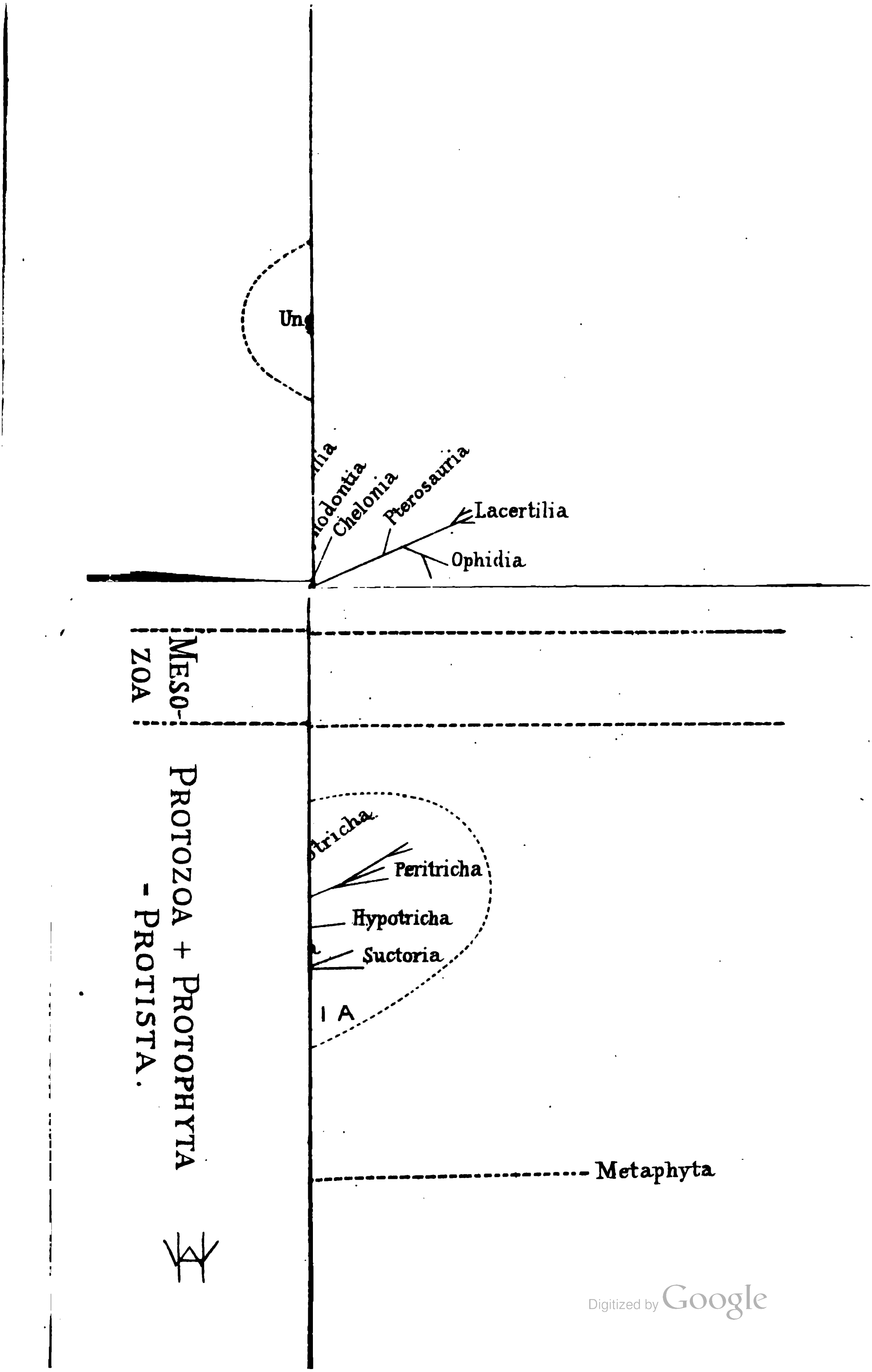
pedia), and the Seals (or Pinnipedia). The Fissipedia are the more direct descendants of the ancestral Carnivora.

Turning now to the line leading upwards to the Primates, the highest Mammals, we find the Prosimiæ represented by a side branch which originates far down, and does not extend to a great height. Then we come to the main divisions of the Quadrumana. First the Arctopitheci, then distinctly further up the Platyrrhini, and still further on the Catarrhini. These three groups diverge, and the last is divided into two series, the Cynomorpha and the Anthropomorpha. From the base of the Catarrhini extends upwards the line leading to the Anthropidæ, comprising Man, the highest product of Evolution.

In this brief description of the Phylogenetic Table some of my statements in regard to the course of evolution, or the exact relations of groups, may seem rather too dogmatic. I have expressed them in that manner simply to avoid circumlocution and the constant use of such words as "possibly" and "probably." Of course a table of this kind can never be more than a temporary classification, although as far as is possible a natural one, and will have fulfilled its function if it represents diagrammatically the present state of knowledge as to the relations between the various groups and the probable course of their evolution.

It is almost unnecessary to point out that horizontal lines could not be drawn dividing this table into sections representing the Fauna of the various Geological Periods. In order to show this a very different table would require to be constructed, in which distance along a line stretching upwards from the base * would indicate merely the age of the

* In such a table the Foraminifera, and other groups of Protozoa, would extend from the base to the top of the table ("Recent"), although they have undergone comparatively little evolution. Some of Haeckel's tables (see *Generelle Morphologie der Organismen*, Berlin, 1866,) are of this nature.


Chelonia
Pterosauria
Lacertilia
Ophidia
MESO-ZOA
PROTOZOA + PROTOPHYTA - PROTISTA.
Peritricha
Hypotricha
Suctoria
Metaphyta

group, and not evolution or advance in organisation as in the present table. Degeneration could not be represented, and it would be impossible to distinguish, except perhaps by colour, between groups which had undergone rapid evolution and those which had remained comparatively stationary.

NOTES ON THE PROPOSED CATHEDRAL FOR LIVERPOOL.

By SIR JAMES A. PICTON, F.S.A., F.R.I.B.A.

The Cathedrals of England occupy a very prominent place in our national history and topography. They form an interesting link of communication between the past and the present. With little intermission the voice of prayer and praise has daily been uttered within their walls during many centuries, and many of the most stirring events in our history have been enacted within their precincts. To a great extent they are history written in stone, and bear the impress of the architectural taste and skill of many succeeding ages. They are not now usually the centres of our great cities. The old order has changed, and left many of them stranded, as it were, in the shallows, whilst the tide of population has flowed away in other directions. Still, their venerable aspect and historical associations will always command respect, and many of them are objects of the deepest admiration from their intrinsic majesty and beauty.

Since the Reformation no new Cathedral has been built in England. St. Paul's is a rebuilding on one of the most ancient foundations. Southwell and St. Albans are merely the adaptation of structures already in existence. Truro, which is more a case in point, is only the enlargement and extension of an existing church.

The erection of a Cathedral in Liverpool will be a new departure, a meeting point for the intersection, so to speak, of ancient and modern ideas, which is fraught with deep interest from many points of view, and opens up many questions, on the solution of which there may be naturally great differences of opinion.

I wish to bring up some of these points for discussion, and to present them as fairly and temperately as I can.

The principal points for consideration are, I think, the following:—

1. The site on which the Cathedral can be placed to the best advantage, having regard to all the circumstances.

2. The plan best adapted for the purpose, and what should be included in the plan.

3. The size and extent of the building.

4. The style of architecture to be adopted.

5. The question of cost.

6. Should an attempt be made to finish the building at one stroke, or should it be a gradual process, carried on through a series of years.

There may be minor questions, but I think the above contain everything essential to the prosecution of the work. I will take them in order:—

As to the site. A Cathedral being intended for the use of the people at large, it needs no argument to prove that the situation in which it is placed should be central in regard to the population: that it should occupy a prominent position, easy of access by leading thoroughfares and means of conveyance; that it should as far as possible be open all round, and that it should be obtainable at a moderate cost.

Many sites have been pointed out, and some very warmly advocated; but it unfortunately happens that those which present themselves as most desirable are already occupied with buildings of an expensive character. Commutation Row has a splendid front looking westward, and if we had the riches of Crœsus or the fabulous wealth of Monte Christo, we might here erect a noble fabric to complete what might be called the Forum of Liverpool; but the purchase

of 10,000 square yards of land and buildings at £20 a yard, costing £200,000, would be simply an idle dream.

Another site very eligible, but not so good, would be Monument Place, London Road, which is attended with the same difficulty.

The three sites which out of those passed under review have most commended themselves are Kensington Fields, St. James's Mount, and St. John's Churchyard.

The first has much to recommend it. It adjoins the leading approach to the city from the east. It is free from obstructions, and contains ample room and verge enough for a building of the most ambitious character, in all probability at a moderate cost.

The main objection to it is its want of centrality. It is situated on what may be called the outer edge of the city, far away from the point where the various avenues meet or intersect, and at the greatest distance from the base line of the river. The surroundings also, consisting principally of cottage dwellings, are not favourable to the display of a great public building, which should represent all phases of human life.

St. James's Mount has found many advocates from the idea of its commanding position on the highest eminence in the city, which it was supposed would constitute it the most conspicuous object within visible range. When closely examined, however, it will be found that these supposed advantages are somewhat delusive, and are neutralised by circumstances which would render the choice abortive.

The situation is far from being central, though more so than Kensington Fields. Placed on a high terrace, on the summit of a steep hill, so far from being conspicuous, a building there erected could not be seen at all until the spectator had mounted the terrace on which it stands. From any point lower down the intervention of houses and buildings

would entirely shut out the view. Again, the site consists of two portions; the front part, a narrow strip of the gardens, elevated about fifteen feet above the adjoining street, on made ground; the back portion, suddenly dropping down about thirty feet to the level of the old stone quarry, now St. James's Cemetery. The formation of a platform brought up from below on which to place the building would be a work of immense labour and expense

Independent of these difficulties there others which are insuperable. The number of parties having pecuniary interests in the cemetery, who would each have to be separately dealt with, such as the Corporation of the city, the lessees or owners of the houses on the Mount, the Cemetery Company, the various owners of graves and vaults who have all freehold interests, would render any attempt perfectly hopeless.

We are thus thrown back on the only other site practically available, that of St. John's Church-yard, and I think if looked at with an unprejudiced eye, it will be found to possess all the essential requisites for the purpose.

As to centrality, it is situated at the intersection of all the leading lines of approach into the city, north and south, and east and west, with tramway and omnibus accommodation, and within a short distance of all the railway stations. It is thus easy of access from every quarter. The site is perfectly open on the north, west and south, surrounded by wide open streets, and as it has a gentle slope from east to west, the west front, which ought to be predominant, would display itself to the best advantage. The surroundings also are favourable. On the north, the buildings of the Free Library, Museum, and Gallery of Arts; on the west, the open area of the Old Haymarket with the converging lines of St. John's Lane, Whitechapel, Victoria Street, Manchester Street, Dale Street, and Byrom Street meeting at this point; on the south, St. John's Lane expands into the wide open

space of the New Haymarket. It would be difficult, if not impossible, to find within the precincts of the city, a site combining so many advantages.

Some objection has been taken on account of the raised esplanade in front of the Free Library, which was intended as the commencement of a high level bridge to cross the valley and extend along Dale Street.

This idea of the high level bridge is now exploded and impracticable. A scheme is before the City Council to remove the embankment entirely, and to throw the street back to the Library with a terrace in front. The area thus thrown open would be about 120 feet in width, forming the finest open space in the city, and displaying the surrounding buildings to the greatest advantage.

The acquisition of the land is comparatively easy. The church is Ecclesiastical property, and only requires the authority of an Act of Parliament to appropriate it to purposes akin to its present uses. There are no private interests to buy up, except that of the patron in the advowson, which cannot amount to a large sum. The grave-yard has long been closed for interments. The parochial duty of the incumbent will devolve in future on the cathedral staff.

Having thus obtained a site, the best possible under the circumstances, what shall we do with it? What should be the extent and description of the building proposed to be erected?

It must be remembered that though this is to be a cathedral, it is not a building for the Roman Catholic ritual, but for the service of the Protestant Anglican Church. There are, therefore, many of the adjuncts of a mediæval cathedral which would be utterly out of place. A Lady chapel at the east end would be a useless excrescence. Side chapels and chantries would be altogether unmeaning. The cloisters, which form so picturesque an adjunct to most of

our cathedrals, were constructed, not as being necessary to the church, but as part of the monastic buildings which usually accompanied the bishopric. Any attempt to bring in these structures as necessary to a modern cathedral would be mere idle pedantry. Sir Christopher Wren made no attempt to introduce these features at St. Paul's, and in the noble cathedral recently erected at Edinburgh they have been very properly omitted.

The next question to be determined is the extent of the building. In several of the letters which have been published the site is condemned as being too small. This will be found on examination to be incorrect. The length of the site from east to west is about 410 feet, and if necessary the west end could be advanced about five yards further. This gives sufficient space for the erection of a building equal to most of our cathedrals divested of the Lady chapels. Wells, which has been held forth as a model, is only 390 feet in length; Exeter, 330 feet; Gloucester, 325 feet; Lichfield, 325 feet. Manchester, is only 216 feet long. Chester, which is a building fully equal to anything Liverpool could require, inclusive of the Lady chapel, is 370 feet long. There is, therefore, ample space for the erection of a building worthy of the city and diocese.

But, it is said, a cathedral should be surrounded by a close, containing a palace for the bishop, a deanery, canons' residences, a consistory court, registrar's offices, etc., similar to Salisbury or Wells. I ask where is the necessity? With the exception of these two, there is not a cathedral in the kingdom which includes them. The Bishops have nearly all quitted the shadow of the cathedrals for more rural surroundings. The Deans mostly live within the neighbourhood of their church, but the Canons residentiary eschew the cathedral close if they have livings elsewhere. In Chester they club together to maintain a residence occupied by

each in turn. A Chapter House, and the various offices, can be provided in the crypt with great advantage, as the slope of the ground westward gives ample opportunity.

There comes now a question of great importance which affects the whole principle of the construction. How far are we bound, and how far would it be expedient, to adhere to the mediæval model, with its nave and clerestory, with arcaded side aisles, transepts, and choir with its ambulatory round the east end? It may be argued that the two objects to be mainly kept in view are—a choir for daily service, of moderate extent, and a large noble nave for public occasions, which would be better adapted both for hearing and seeing in one span without piers, arches, or side aisles. The facilities afforded by modern science render the old arcaded principle entirely unnecessary. The advantage of an unbroken span is well seen in the vast multitudes who are gathered under the dome of St. Paul's from week to week. It may be said, that the mediæval plan of the cathedral churches arose out of a mere accident, that of the ancient basilicas or courts of justice having been granted by the Emperor Constantine for the purposes of Christian worship. These buildings had a central aisle, with a high roof, and a lean-to aisle on each side. At the upper end a portion was railed off for the officials, which was hence called the cancellum or chancel, and a recess at the extremity formed the seat of a judge. That the Christian hierarchy were not specially wedded to this form of construction is evident from the adoption of the Pantheon, which is a circular building, covered with a dome, without any colonnade or arcades; and the great hall of the baths of Diocletian, the model of our St. George's Hall, which has been from an early period converted into a Christian church.

All this is very true, and if we could divest our minds of association and prepossession, it might be possible to strike

out a new path with advantage, but I believe this to be impossible. The proposed construction of a cathedral at all is principally due to the existence of unbroken tradition, and a desire to link the present age with the historical church of the past. Dr. Johnson observes in a memorable passage, "to abstract the mind from all local emotion would be impossible if it were endeavoured, and would be foolish if it were possible. That man is little to be envied—whose piety would not grow warmer among the ruins of Iona."

It is this feeling of sentiment which imparts the charm to our ancient cathedrals, and which would give the tone to any modern attempt at its realisation.

I am not now speaking of the style of architecture, but of the plan and arrangements of the building. We have been so accustomed to look in a cathedral for nave and aisles, choir and transepts, triforium and clerestory, piers and arcades, that any departure from the mediæval model would grate upon our sense of propriety and fitness.

With this view, I think the great majority of those interested would concur, whilst any departure in search of new adaptations would give rise to differences of opinion which might be fatal to the scheme.

If we take the cathedral of Wells as our model, as propounded by a writer not very favourable to the present proposal, we find a nave 150 feet long, transepts 60 feet wide; the choir, independent of Lady Chapel, 125 feet, or length over all, including Lady Chapel, 390 feet. For a building of this extent, there is space enough in St. John's Churchyard. The proportions here given are such as to satisfy and recommend themselves to any ecclesiologist, and sufficient for a building possessing a dignity worthy of our great city.

The plan and extent of the building being determined, in what style shall it be erected? There is here legitimate

scope for great diversity of opinion. It by no means follows, if the mediæval traditions be followed as to plan and arrangement, that the building must necessarily be in the pointed style. St. Peter's, the great central church of Christendom; St. Paul's, the cathedral of our own metropolis; the cathedral of Rennes, in France, with others on the Continent, are in the revived classical style. There is, therefore, no inconsistency or impropriety in the adoption of any style which may recommend itself on the score of beauty or usefulness.

Let us inquire for a moment as to what the *result* has been.

St. Peter's, at Rome, with all its faults, has that air of grandeur and power which characterises everything to which Michael Angelo set his hand. But its greatness does not strike the eye at once. It is not the result of enormous height in proportion to width, nor of a series of arcades receding from the eye in long lines of perspective. Its great characteristic, in its general lines, is harmony of proportion, which is in itself no element of greatness, and may equally exist in a building of any size, large or small. The eye seeks for some scale to measure by, and it is only after this is attained, and applied gradually by the eye to the details of the structure, that its real majesty can be appreciated. The richness of the decorations, and the beauty of form everywhere presenting itself, appeal to other perceptive faculties. Now a Gothic cathedral, such as Beauvais, Cologne, Amiens, York, or Westminster, by its development in height, and unbroken length, and its seemingly endless lines of vault and arch, appeals at once to our feeling of awe and sense of power.

Let us now glance for a moment at the other great classical cathedral, St. Paul's, in London. It is a noble monument of the genius of Wren, working under somewhat

unfavourable conditions, since it is well known that he felt hampered and restricted by the adoption of the mediæval plan of the building imposed upon him by the ecclesiastical authorities. The result is a structure fraught with singular inconsistency. Internally, it follows the mediæval traditions. It has its nave and choir and transepts, with side aisles, and the clerestory and triforium above, and its piers and arches dividing the centre from the side aisles. Looked at externally, these features are no longer recognisable. What we see is a classical building in two orders, of equal height all round. There is no indication of centre and side aisles. What we do not see is the fact that the upper story in great part is a mere blank wall, carried up to mask the clerestory windows, and is so far a sham and a deception. Working under these unfavourable conditions, the marvel is that so much grandeur and beauty could have been the result. In the hands of an ordinary man, it must have been a failure and an eyesore.

There seems to me nothing in either St. Peter's or St. Paul's to recommend the classical style for adoption in our proposed cathedral. If, as I suppose, the mediæval ground plan is insisted on, either the sham device of St. Paul's must be adopted, or, if the side aisles and clerestory occupy their normal position, the structure at best would resemble the cathedral at Florence, which, notwithstanding its beauty of detail, in general effect by no means recommends itself to our modern sense of beauty and propriety.

Whether rightly or wrongly, we have come to associate in our minds the Gothic style with our religious edifices. The modern Gothic rage, which had a run of forty or fifty years, and has flooded our towns with buildings for secular purposes, of the most inappropriate and inconvenient character, rom the Houses of Parliament onwards, culminating in the universally denounced Law Courts, is now, let us hope,

drawing to a close. We owe a debt of gratitude to Lord Palmerston for stopping the flood-tide of quasi Gothic and initiating the introduction of the modified classical or Italian in the range of Government offices at Whitehall.

For ecclesiastical buildings, there is no question but the general voice would declare in favour of the Gothic style. Tradition, association of ideas, prepossession, prejudice, if you will, all tell in its favour. A new cathedral in a new bishopric, setting at naught all these reminiscences, would appear to be an intruder, hardly calculated to take rank with its elder sisters, clothed in a different garb, and suggestive of different ideas.

But it is said, consider the inconsistency of erecting a Gothic building in the immediate vicinity of St. George's Hall, the embodiment of pure classic taste. Will there not be an inconsistency, a hopeless incongruity between the two structures, injuring the effect of both?

My reply is very decided. If I wanted rivalry, if I wished to draw odious comparisons between the two buildings, I would have them both erected in the same style. There would then be a thousand points for comparison and criticism. The order employed, the distribution of parts, the columnar arrangement, the fenestration, the nature and degree of decoration, down to the minutest detail, would afford inexhaustible scope for disparaging observations, and damaging comment on one or the other. Erected in different styles, each would be expressive of a different class of ideas; each would be a representative building. Law, order, cultivation, refinement, education would be typified by the one, religion, charity, devotion, self-sacrifice would be indicated by the aspiring lines and graceful curves of the other. The one is expressive of the relations of man to man, the other shews forth the connection of man with God. Each would be supplementary to the other, and thus combined

they would occupy the ground of all the relations of humanity. Is this a fanciful and transcendental view? I think not. We are governed by ideas, and these take their rise from various sources, and are insensibly but powerfully affected by the circumstances and surroundings of our daily life. The adaptation of the Gothic style to church architecture has almost become an established principle. There is not an Episcopal church or a Dissenting chapel now built but, with very slight exceptions the Gothic style is adopted. On every ground, then, of association, of established custom, of adaptability, of intrinsic beauty, of public opinion, I believe the Gothic style is that which ought to be adopted.

But which Gothic style? I suppose no one at this time of day would advocate building a cathedral in the round-arched Norman style. This is so obvious as to go without saying. We have then the choice of three centuries of the pointed style, ever changing, either for better or worse, until it ultimately fell into decadence, and expired. In designing in the pointed style, what principle should be kept in view? Are we slavishly to select a particular period or date, and blindly to follow in the wake of the designers of that day, priding ourselves on what we call the purity of our work, and simply reproducing forms invented by those long passed away? Not such was the spirit of the glorious mediæval builders. The one characteristic which pervades all their work is its freshness and originality. Each man brought something new to add to the stock of ideas already existing. They are occasionally inconsistent, sometimes incongruous, but we never think of that when we contemplate the results, frequently noble and sometimes exquisite. Here we find the great difference between the mediæval Gothic and its modern revival. The one is spontaneous, a living growth, a natural development; the other, a frigid reproduction of bygone

forms, a deceased body galvanised into seeming life when the spirit has departed.

What, then, under such circumstances, should be the course of the modern Gothic architect? He cannot do better, I think, than imitate the example of his predecessors in the days of yore. They took the prevailing style of the day as they found it, adapting it to their own circumstances, and introducing new ideas as they suggested themselves. As the ages became corrupt, so the ideas became debased, but as long as freshness and vigour prevailed, the form and pressure of the age manifested itself in the glorious works of the three centuries of the supremacy of Gothic art. Surely genius is not dead and buried in these modern days; surely all invention is not at an end. As well might we clothe ourselves in the garb of our ancestors of the fourteenth and fifteenth centuries, as be content blindly to reproduce and copy the exact detail of those who have preceded us, and worked on a different stage, with different influences surrounding them. What is wanted is, that the modern Gothic architect should imbibe the spirit of his mediæval predecessors, and thus imbued, should advance on the same lines with fresh adaptations of plan and arrangement, and new developments of beauty in decoration. Something in this direction has been done in France, and more in Germany in the modern Gothic revival. The architects have freely drawn upon the ancient examples, and have combined and adapted as suited their purpose, without hampering themselves with pedantic restrictions as to dates and periods. The result, though occasionally it would shock some of our English ecclesiologists, in many cases is highly satisfactory and successful. In some cases, instead of the usual clerestory and triforium, with lean-to side aisles, there are three vaulted aisles of equal height and width. In others, the central aisle spans a large proportion of the width, with

vaulting on a noble scale, the two side aisles, carried to the the same height, being mere accessories for an ambulatory round. The details also are culled from any source where beauty can be found. Window tracery is indiscriminately combined, whether it be geometrical, flowing, perpendicular, or flamboyant. Let not any harsh *à priori* judgment be passed on this mode of treatment. Let it be fairly examined and judged upon its merits. Some approximation to this new departure has been made in England, especially by the late Sir Gilbert Scott, who has, in secular buildings at least, freely introduced the Italian style of Gothic with considerable success, as also by the late Mr. Street, in some of his beautiful designs in brick.

I say then let the inventive faculty of our architects have free play. Let us not be slaves to precedent where it hampers and cramps originality. The tree is known by its fruits, but the fruit may present a variety of form, colour and flavour, each valuable in its place and season. I only claim the same privilege for the modern architect which was enjoyed by his predecessors of old, without which the beautiful buildings which they have bequeathed us could never have come into existence.

The next point to be considered is that of cost.

I am sorry that this question has been introduced into the instructions to the competing architects as, being an element in the competition it may clip the wings of fancy, and prejudice the development of noble and grand ideas. The sum named, £300,000, is a large amount, and if it is thought necessary that such a sum should be raised or promised before the building is commenced, the erection would have to be postponed to the Greek kalends, or what is the same thing, adjourned *sine die*.

It appears to me that the question of cost is one of the least important in the transaction. No one can imagine,

unless a miracle of liberality were to take place, that the sum just named could be raised within any moderately limited period; and any spasmodic attempt of the kind ending in failure would be a great discouragement to the undertaking. The building to be erected is not for this generation merely, but intended for all time, and it is only reasonable that each age as it passes should contribute its quota and leave its impress on the structure. It was in this way that the grand old cathedrals of the past grew up and developed. They all occupied a long period in building. Salisbury, which is the nearest approach to a single design, was nearly forty years in construction before it was ready for consecration, and was not completed within a hundred and fifty years from its foundation. One great charm of our cathedrals is the impress they bear of each succeeding age. They are histories in stone, reflecting the ideas of successive generations as they passed, crystallising so to speak, their floating notions of beauty and grandeur into visible shape. Take for example the cathedral of Chester, really built for an abbey church, and by no means one of our most imposing ecclesiastical buildings, yet it presents us with specimens of every style of mediæval art, from the rude early Norman to the latest Tudor period of decadence. The general effect is harmonious, because we feel there is life, reality, progress, development in the whole series. Any modern attempt at bringing together such a variety of styles into one building would result in disastrous failure, for the simple reason that we should feel that the whole was a mere sham and pretence, something like galvanising a set of Marionettes to represent life.

The human mind has not yet hopelessly sunk into imbecility and incapacity. There are latent capabilities in art as well as in science which only require circumstances to bring them out. Are we to suppose that in every other faculty which contributes to human happiness there is pro-

gress and development, but in architecture there is to be nothing but stagnation, no new combinations, no fresh forms of beauty or grandeur? I would repel the idea as degrading and false. Let each generation pursue its own course, drawing its inspirations of beauty from nature, of plan and arrangement from experience and convenience, and of construction from science and practice. In pursuing this course, and in no other way, is progress possible.

To apply this to the subject before us. Let a design be prepared, the best which can be obtained, embodying the ideas which now recommend themselves after due consideration, and let a commencement be made with the means at our command, beginning with the choir. This will not make a very excessive demand upon the liberality of the public. If £10,000 per annum could be raised during five years very satisfactory progress might be made, and the key-note of the building be struck. Future development might then be safely left with the coming race. If the structure supplies a felt want; if the cathedral institutions adapt themselves to the necessities of the times; if they combine intelligence with devotion; if instead of setting themselves against the expansion of modern thought, they move on the same lines, fearlessly trusting that the cause of truth, whatever difficulties it may meet with, must ultimately prevail, the cathedral may become a great power amongst us—a centre from which religious and moral influences may radiate on every side, and pervade the dark and desolate regions of our city with the light, and warmth, and life of Christian truth and benevolence.

I have thus endeavoured briefly to draw attention to the leading points for consideration in the present scheme. The undertaking is an important and responsible one, and can only succeed by a vigorous and united effort. There is

scarcely a question raised on which there will not be differences of opinion, and if each is persistently to maintain his own view and refuse to co-operate with others, it is clear that failure must be the result. This would hardly be creditable to those who profess to take an interest in the subject. If, as I have attempted to show, the mode of procedure clearly points itself out, it only needs a spirit of conciliation and co-operation combined with earnestness to ensure a triumphant success.

CONCLUDING NOTE.

Since writing the above, my attention has been called to an article in the last number of the *Nineteenth Century* on the same subject, by Mr. James Fergusson. Anything from the pen of so distinguished an architectural writer is worthy of all respect and consideration, and, on the whole, I think the article is favourable to my own view. Mr. Fergusson (p. 901) thoroughly approves of the site selected. He denounces the idea put forward of reproducing Wren's model for St. Paul's (p. 903). He admits that no architect at the present day would propose to build an English Church in any other than the Gothic style (p. 906). He approves of the freedom with which Sir Edmund Beckett has treated the west front of St. Alban's (p. 904). Considering the thirteenth century style a foregone conclusion, he deprecates the gloom and want of light too commonly associated with that period; and after all this he comes to the conclusion that "we must revert to the position in which architecture was left in the reign of Queen Anne if we want to find a style in which progress is possible, and which can consequently be

adapted to our wants and tastes," and presents a plan and section of an edifice on these lines.

I fear this result will fall very flat on the public ear, and that Mr. Fergusson's arguments will be preferred to his design. Those arguments very conclusively show that Gothic of some description is the only style possible.

THE RELATIONSHIP OF PALÆONTOLOGY TO BIOLOGY.

By R. J. HARVEY GIBSON, M.A., F.R.S.E.,
DEMONSTRATOR OF ZOOLOGY, UNIVERSITY COLLEGE, LIVERPOOL.

Each of the two great departments of Natural Science, known as Palæontology and Biology, includes a vast array of facts, laced together by a series of hypotheses for which the facts afford foundations of greater or of less stability. The facts have been ascertained and the hypotheses have been advanced in both departments by a host of observers, amongst whom we may number some of the most famous men in history.

It is not my intention to investigate the accuracy of the facts, or the validity of the inferences, either in Palæontology or in Biology. I desire rather to accept as beyond question the accuracy and validity of both series of phenomena, and to endeavour to draw certain general conclusions bearing more especially on the relationship of the two series to each other.

Generalisations are, I think, always more liable to error than specialisations, and it is, therefore, with some diffidence that I venture to advance the views which the following remarks are intended to illustrate, especially as in doing so I find myself advocating principles which, if carried into practice, would necessitate considerable rearrangement in the methods of teaching at present recognised and adopted, both in Palæontology and in Biology. My only justification is that old things are not necessarily true things; and that new things, though imperfect and in many respects erroneous, may contain the germs of still newer and more perfect developments.

Not that the views I desire to call your attention to are entirely new. They have been suggested with greater or less emphasis and clearness already; but the casual way in which they have been introduced, and the inattention paid to the suggestions themselves, lead one to think that their importance has not been sufficiently appreciated.

Even at the risk of being tedious it is always preferable, I think, in any attempt to demonstrate some new aspect of scientific enquiry to proceed from the known to the unknown, and to lead up to new conclusions, whatsoever they may be, through conclusions already well established, rather than to proceed at once to the exposition of previously unexplained phenomena.

First, then, what is Palæontology? From a host of definitions scattered through the various geological text-books, I select that of Dr. Arch. Geikie, given in his valuable text-book of Geology (Macmillan & Co., 1882). It is as follows :—

"Palæontology treats of the structure—affinities—classification and distribution in time of the forms of plant and animal life imbedded in the rocks of the earth's crust."

The definition is followed by explanatory remarks to which I shall afterwards refer.

The point I wish to draw special attention to in this definition is the fact that under the subject of Palæontology are included :—

a. The Morphology.

b. The Distribution in time.

c. The Phylogeny, and

d. The Classification of extinct plants and animals.

Physiology of course cannot be treated of. In other words, geologists answer, or attempt to answer, three out of the four questions which form the "test act," so to speak, of all organic matter, whether animal or vegetable. They even

attempt in many cases to hint what in all probability was the habit and mode of life of extinct forms. They would no doubt explain all the physiological processes which took place in the organism of which the hard parts now alone remain—if they could.

What in the next place is Biology? I shall cite only Professor Huxley's definition in the article "Biology," *Ency. Brit.*, 9th edition:—

"The Biological Sciences are those which deal with the phenomena manifested by living matter."

The two subjects are obviously not on an equal footing. Palæontology is a division of Geology, or is at least tacked on to that science; Biology, on the other hand, stands distinct.

Let us glance briefly at their historical development, and endeavour to see how that explains their position.

In considering first of all the science of Geology, we may pass over without remark, as outside our present subject, the long period in its history during which it developed out of a mass of tradition and imagination into a more or less definite body of scientific truth under the influence of the early Italian school.

Strangely enough the first memoir which might be termed scientific on a Geological subject, was palæontological, and was published by Fracastoro, in 1520. He contended that the fossils found in the rocks were the remains of organisms previously existent on the earth's surface, and entombed upon their death by natural causes.

With the exception, however, of this work, and the observations and opinions of the few Italian thinkers who brought to the study of Geology minds free from prejudice, a sketch of the progress of geological enquiry from the close of the sixteenth to the middle of the eighteenth century, is the history of a constant and violent struggle of new

opinions, which form the most self-evident propositions of Geology as we understand it, against doctrines, either emanating from minds to whom no propositions however ridiculous seemed unworthy of the ordeal of argument, or "sanctioned by the implicit faith of many generations, and supposed to rest on Scriptural authority."

At length, towards the end of the eighteenth century, the keynote of modern Geology was sounded, when Generelli exclaimed before the Academy of Cremona:—"I hold in utter abomination, most learned academicians, those systems which are built with their foundations in the air, and cannot be propped up without a miracle; and I undertake, with the assistance of Moro, to explain to you how these marine animals were transported into mountains by natural causes."

The careful observations of Moro, Gesner, and Michell, of Pallas, Saussure, and many others, form a refreshing contrast to the absurd hypotheses of their predecessors, and in their works, though Palæontology still occupies the chief place, we see gradually awakening a desire to apply the same methods of reasoning to the phenomena of Mineralogy, of Stratigraphical and Dynamical Geology.

The advent of Werner raised Mineralogy to the chief place among the sciences of the inorganic world. Dynamical Geology received its first scientific exposition at the hands of Hutton and Playfair. Experimental Geology was founded by Sir James Hall, while Desmarest first grasped the conception of a Physical Geography of the earth's surface. But to all these investigators Geology, meaning the study of the structure and mode of origin of the strata of the earth's crust, was looked upon as a subordinate division of the subject to which each was severally devoted. Probably William Smith, an English surveyor, who lived at the close of the 18th century, was the first to treat the science of Geology in a truly scientific manner. Certainly it is to his genius

that we owe the demonstration of the use of fossils to the Geologist and the indication of the proper place that Palæontology should hold in Geological enquiry.

As now understood Geology embraces seven more or less inter-dependent sub-divisions.* These are:—

I.—Cosmogony, which treats of the earth as a whole, its relation to other heavenly bodies, its own particular movements and probable origin.

II.—Geognosy, which describes the constituent parts of the earth, the minerals and rocks of which its crust is composed.

III.—Dynamical Geology, which embraces an investigation of the operations which lead to the formation, alteration, and disturbance of rocks.

IV.—Structural Geology, which deals with the architecture of the earth, and the mode of arrangement of the various materials composing its crust. Structural Geology is thus the statical aspect of Dynamical Geology.

V.—Palæontological Geology, which has already been defined.

VI.—Stratigraphical Geology or Geological History, which endeavours to work out the Chronological succession of the great formations which form the land surface of the globe.

VII.—Physiography, which traces the gradual development of the stratigraphical features presented to us.

Palæontology, therefore, which to the first Geologists meant all Geology, and round which the battle of reason *versus* dogma and prejudice raged for centuries has gradually sunk from its higher place to occupy that of a dependency of Geology proper, though forming a basis, as first shewn by William Smith, for the elaboration of another section—that of stratigraphical Geology.

I wish to advocate a further step to-night—namely, the

* *Text-Book of Geology*, by Dr. A. Geikie.

severance of Palæontology, as such, from Geology altogether.

Under what department of science is Palæontology then to be included?

Before answering that question it is necessary to have a clear notion of the general scope of Biology and the origin of the term.

Since the demonstration of the fundamental sameness of protoplasm as forming the physical basis of life, whether animal or vegetable, it has become customary to unite the two sub-sciences of Zoology and Botany under the one science of Biology, a custom which must be followed ere long by the recognition of the essential relation of Psychology and Sociology to the same general science. In fact, as Professor Huxley puts it,* "It must be allowed that no natural boundary separates the subject matter of these sciences from that of Biology."

Living matter and the products of its metamorphosis may, according to the Biologist, be regarded under four aspects:—

I.—Morphological.
II.—Physiological.
III.—Distributional.
IV.—Etiological.

In other words every living thing has structure, functions, habitat, and relationships with other organism, both recent and extinct.

These then are the "phenomena manifested by living matter," with the consideration of which the Biological Sciences are occupied.

Now, when we talk of studying the "phenomena manifested by living things," what do we really mean? Save the external features we cannot study the morphology of living

* *Anatomy of Invertebrate Animals*, p. 1.

things at all. The very act of examination is and must be preceded by the death of the organ or organism, except where the tissues are so transparent as to admit of examination without dissection.

Do we study the physiology of living things, then? Save of the more apparent functions of locomotion, and the more obvious developmental changes, do we really know anything of the physiology of *living* plants and animals? Are not, as Professor Burdon Sanderson says, "the structure and functions of active living protoplasm entirely unknown?" The phenomena of distribution might equally well be studied in the dead as in the living matter. The phenomena of etiology we cannot treat of otherwise than by inference.

I by no means wish to argue that the definition of Biology given above is unsuitable or erroneous; on the contrary, I am willing to accept it with the proviso that in dealing with the phenomena of Biology we understand these phenomena, which we may, from an examination of the dead forms, supplemented by such general results as we are able to obtain from a study of living forms, legitimately infer to be characteristic of the plant or animal in its active living state.

An instance of the importance of this view of looking at the subject matter of Biology may not be out of place here.

A great deal has been said and written of late about intracellular and intranuclear protoplasmic networks; and it is dogmatically stated in many physiological text-books that, in the active growing cells forming the tissues of a plant or an animal, there exist dense networks of protoplasmic threads, forming a reticulum in the interior of the cell, and often of the nucleus also. I do not wish to contradict these statements—rather to confirm them, save in one particular—that in very few cases (*e. g.*, eggs) have these reticula been seen and demonstrated in active living cells. Such a

demonstration, at least in the great majority of plants and animals, is impossible; the very act of examination places the cell or cells under unnatural conditions—conditions which are entirely adverse to the life of the cell. Indeed the protoplasmic networks in the blood-corpuscles of many Amphibia are not visible until some time subsequently to the shedding of the blood. The protoplasmic network, or at least the evidence for its existence, is forthcoming only as a result of a pathological change in the protoplasm—a species of coagulation, in short. How many of the other instances of intracellular reticula may it not be possible to explain in a similar manner, especially when we recollect through what varied treatment the tissues to be examined have to pass ere histological demonstration is possible?

But if the view I have taken be accepted, why may not the biologist discuss the remains of organisms buried in the crust of the earth, from the same four points of view? Where, indeed, will the palæontologist draw the line of demarcation between the fossil and the recent?

The past life of our globe passes by gradations, more or less insensible, according to the completeness of the geological record, into the life of the present. Life in all its fundamental principles has been one since it first appeared. The conditions under which it originated we may not as yet have grasped, but there can be no doubt that the physical basis, which in obedience to the laws of variation, produced the trilobites of the Silurian, or the ammonites of the Jurassic, was the same as that which under similar laws forms the basis of life in the innumerable varieties presented by the different species of living plants and animals.

I hold, then, that Palæontology is a branch of Biology, and not a subdivision of Geology—that a discussion of the structure, affinities, classification and distribution in time of fossils, is a biological problem, not a geological one. I would

even go the length of advocating the abolition of the term Palæontology, since its use is calculated to emphasise the distinctness of the study of fossils from the study of recent forms—a distinctness which does not exist. *

How then is Biology to be arranged, so as to include this new mass of material? Simply enough. By the admission of the essentially genealogical nature of classification, and the introduction into that classification of the different groups of plants and animals that lived in past ages. If the doctrine of Evolution be true—if all living forms be descended from common ancestors—then all ancient forms must be entitled to a place in a biological classification. That many such forms will for long remain in a doubtful relation to the general tree is a misfortune, due to circumstances beyond our control. But that need not hinder us from attempting such a classification. It does not do so in the present state of zoological knowledge. There are many living forms whose nearest relationships have not as yet been decided upon definitely.

We shall be unable, it is true, to give account of the soft parts of ancient living things. We shall be unable to do more than guess at their habits and mode of life— again a misfortune, but no reason, it seems to me, why we should omit to describe those parts which are left, in a general account of the plant and animal worlds.

On the other hand, the subject of etiology can be discussed with every prospect of attaining to the most interesting and important results. Instance the etiology of the

* "To the study of fossil organisms a distinctive name—Palænthology—has been given, as if it were a separate and independent science. The term is undoubtedly a convenient one, but its adoption has been in certain respects unfortunate, inasmuch as it has tended to foster an impression that there is some essential difference between living and extinct forms of life."—D. Arch. Geikie, F.R.S., in the Presidential Address to the Royal Physical Society of Edinburgh, 1888.

Herbivora and of the Birds, as worked out by Huxley and Marsh respectively.

It is in the subject of distribution, however, that the importance of uniting Palæontology and Biology is specially apparent.

Distribution may be either geological or geographical—that is to say, it treats of the distribution of plants and of animals in time or in space. The true relationship of these two phases of the distributional question does not seem to me to be sufficiently well brought out in text-books. We are apt to think of distribution in time as merely the order in which different grades of organisms have appeared on the globe; and distribution in space as a census of the inhabitants of the different sections into which the surface of the land has been divided. But distribution in time is something more than mere chronological order of succession, and the two aspects of the subject, though apparently as disconnected as depth and breadth, are in reality inseparable.

"History" has been defined as "statistics in movement," "Statistics" as "history in repose," and in geological, as in civil history, this is true. Geographical distribution is a statistic of the present distribution of animals and plants on the earth. Each period in the history of the earth has its own geographical distribution of organisms. These are all statistics, and since there are an indefinite number of separate "horizons" in the succession of rocks, we may say there are an indefinite number also of statistics of geographical distribution. The sum of these piled on each other forms distribution in time or geological history. Geographical distribution, as we understand it, therefore, is simply the last census of living things, the first preserved otherwise than by the rocks themselves. Here again, imperfections in the geological record — destruction of entire series of strata — and ignorance of the geological history of the crust

of the earth, save in certain parts, prevent us from attaining as perfect a knowledge of past geographical distribution as we should wish; but, nevertheless, the main features of Geographical Distribution in the tertiary period, at least, seem in a fair way of being discovered; and no doubt, as further research is made by the various national surveys, the doubtful points relating to that epoch will be cleared up, and knowledge will be more and more increased with regard to the secondary and primary periods of geological history.

If the subject of Palæontology then be simply a branch of the wider science of Biology, in what sense may the geologist treat of the fossils which he will constantly meet with in his examination of the earth's crust? Obviously he may discuss them from two points of view. First, and less important, in so far as they form actual rock masses, *e.g.*, limestone and chalk. Secondly, as guides to the establishment of the correct order of superposition of strata.

In the remarks with which Dr. Geikie follows up his definition of Palæontology, he refers in few words to the biological as contrasted with the physical aspects of Palæontology, and consistently discusses under the head of Palæontology only the physical aspect of the subject. The biological aspect is, however, dealt with fully in the section on Stratigraphical Geology—a procedure which is justifiable on the ground that biologists have not yet learned that it is their duty to furnish the geologist with a complete account of the structure, affinities, and classification of extinct forms so far as circumstances permit them to do so.

Hitherto I have treated the subject solely from a theoretical point of view; and, although on theory it may seem advisable to unite Biology and Palæontology, yet in practice it might be inexpedient to alter their present relationship.

I shall endeavour now to shew that not only is it possible and expedient to unite the study and teaching of Palæonto-

logy and Biology, but that the advantages to be gained by such a union are such as to freely justify the alterations that would be required.

There can be no question, I think, but that the gain to Geology would be great. For not only would the time at present spent on Palæontological studies be available for the study of the more important phenomena of structural and dynamical Geology, but the geologist would be spared the necessity and perfectly needless labour of acquiring a knowledge at first hand of the innumerable fossils whose meaningless names must have suggested emphatically enough that they were the dry bones of Biology. Now that the order of superposition of rocks *has been* ascertained, what need to repeat in every course of lectures, and in every text-book, the list of the names of the various forms of plant and animal life found in these strata. All further discovery of the presence or absence from certain strata of certain fossils is a biological discovery, and has to be discussed under the distribution in time of the group to which the discovery refers. It would be always instructive no doubt to indicate the leading features of the organic world at the same time as the characteristic physical features of any epoch; but all details I would leave to be studied under Biology.

Looked at from the biological point of view, what are the advantages to be gained by this rearrangement?

The advantages it seems to me are many.

1st. With regard to classification. It is only of late years that a true conception has been arrived at as to what classification really is. For long physiological classifications, which introduced such absurdities as the grouping together of whales and fish, of birds and bats, were discussed seriously. Artificial classifications, like that of Linnæus, founded on the morphology of one organ or system, failed of necessity to throw any light on the phenomena of plant or of

animal phylogeny. The accurate morphological researches of Cuvier, the embryological work of Von Baer, and the profound generalisations of Lamarck and Darwin were needed ere classification was seen in its true light.

"Some deeper bond is included in classification" says the last and greatest of these workers, "than mere resemblance. I believe that community of descent, the one known cause of close similarity in organic beings, is that bond."

But acceptance of the view of community of descent from a generalised ancestral stock of necessity signifies the acceptance of the unity and continuity of plant and animal life since its origin. It means that all the innumerable plant and animal forms that exist now, that have existed in past ages, whether preserved in the rocks or no, are leaves, twigs, and branches of one great tree whose roots are hid deep in the unknown pregeological time, whose latest blossoms are unfolding around us to-day.

"We can understand," writes our great master in Biology, "how it is that all the forms of life, ancient and recent, make together a few grand classes; we can understand from the continued tendency to divergence of character why the more ancient a form is the more it generally differs from those now living; why ancient and extinct forms often tend to fill up gaps between existing forms, sometimes blending two groups previously classed as distinct into one; but more commonly bring them a little closer together. The more ancient a form is the more often it stands in some degree intermediate between groups now distinct; for the more ancient a form is the more nearly will it be related to, and consequently resemble, the common progenitor of groups, since become widely divergent. Extinct forms are seldom directly intermediate between existing forms, but are intermediate only by a long and circuitous course through other extinct and different forms. We can clearly

see why the organic remains of closely consequitive formations are closely allied; for they are closely linked together by generation. We can clearly see why the remains of an intermediate formation are intermediate in character."*

No greater step toward the embodiment of such teaching as this in actual fact, can, I think, be made, than by the amplification of our zoological and botanical tables of classification by the addition of the families of animals and plants that lived in past ages. Innumerable problems will no doubt, at once suggest themselves, and there will be ever so many groups of extinct forms whose precise position on such a classification it will be most difficult to determine. These difficulties may, however, it seems to me, be in great measure got over by, in the first place, always adopting an arboreal or genealogical form of classification and by absolutely discarding the unmeaning, if not actually pernicious tabular arrangement; and secondly, by the judicious use of such expressed or unexpressed hypothetical links as are made use of by Balfour, for example, in his explanation of the phylogeny of the Chordata. Probably also were biologists really to tackle the problem of the structure and affinities of fossil organisms, their knowledge of recent forms might enable them to suggest solutions of difficulties which the experience of the geologists might never have led them to guess at. Witness the recent demonstration of the arachnoid affinities of Limulus, and of the extinct Trilobites and Eurypteridæ.

Biologists owe their best thanks to Professor Herdman, of Liverpool, and to Professor Haddon, of Dublin, for the papers which these gentlemen have recently published. It is not necessary for me to do more than recall to your memory Dr. Herdman's paper read before this Society some three or four meetings ago. His system of classification was strictly

* *Origin of Species*, p. 314.

genealogical, and in two dimensions of space as contrasted with the continuous tabular classification in one dimension of the old zoologists. The dendritic method had, of course, been used before, but Dr. Herdman has, it seems to me, materially improved that method by the introduction of various peculiarities in the manner of demonstration of relationship and degree of differentiation.

Some will, no doubt, remember that Dr. Herdman on the occasion of reading his paper referred to Mr. Haddon's publication in which an attempt is made to explain how the genealogical relationships of extinct and living animals might be demonstrated by means of a solid model, by a classification in other words in three dimensions of space.

The apparatus Mr. Haddon has invented is capable of demonstrating *separately* phylogeny and classification of living forms. It is, however, I think, extremely desirable, in elaborating such an apparatus, to aim especially at the representation both of phylogenetic relationship and classification on the same model contemporaneously.

For that purpose Professor Haddon's model seems scarcely suited. It admirably illustrates these aspects of the question separately, but the adaptation of the model for the purpose of demonstrating both series of phenomena at the same time would be difficult if not impossible.

Might it not be possible to construct a veritable tree of wire of various thicknesses. All living groups might be represented by means of a series of named blocks of wood, as suggested by Mr. Haddon, but all the wires bearing the names of living forms might be brought to the same level, that is, to the level of the top of the tree. The wires representing the various extinct forms would then naturally stop at heights varying in accordance with the known facts of Palæontology and stratigraphical Geology. Perhaps these wires might be coloured of different tints at different

heights, using the colours which indicate specific horizons in the Geological Survey maps.

Further, the thickness of the wire might be regulated by the size of the class or family to which it corresponded. Thickening or thinning of the wire would indicate the waxing or waning of the group whose tribal history it represented. The sudden alteration of the thickness of the wire would thus indicate a gap in the geological record; a gradual alteration would suggest that the tribal history of the family was tolerably completely known.

It would not be essential, it seems to me, to indicate rapidity or slowness of organic differentiation or degeneration on such a model, since the knowledge of the structure of the various groups should be learnt in the laboratory and not in the lecture-room, for the purposes of which latter I consider such a model specially adapted.

Detailed classifications of separate groups might be made for detailed study, whilst a generalised model, shewing larger groups only, would serve for general work.

Whilst some attempt has been made to express phylogenetically the relationship of the various groups of animals, so far as I am aware, no attempt has been made to overturn the antiquated classifications of botanical orders first started by Jussieu.

In no text-book of Botany that I am acquainted with, save that of Professor Behrens, is there any attempt made to unravel the mystery of plant relationship; and even there, the phylogenetic classification offered seems as though it were advanced with humble apologies to the shades of Ray, of Jussieu and Adanson.

What would we think of a course of lectures on Zoology where no attempt was made to give any account of the Invertebrata, but rather to spend the hours in discussing minute and unimportant points of the difference between

various genera, species, and even varieties of Vertebrates; where no mention was made of fossil forms at all, and where the word phylogeny never occurred?

And yet, in one at least of our Universities, a perfectly analogous course in Botany is year by year delivered.

The briefest reference is made to Cryptogams, and the student never hears of the existence of Algæ, Fungi, Schizomycetes and Myxomycetes, and all the host of low plants which are comparable to the Invertebrata in Zoology, whilst even the plants which are intended to illustrate the natural orders of Phanerogams are distributed and discussed haphazard, just as they happen to be in flower. When we recollect that the great majority of the students so taught are medical students, and that owing to this unscientific method of studying Botany they never hear of Bacteria till they meet with them practically in the wards of the infirmary, or in the slums of our great towns, the gravity of the omission becomes more apparent.

It is surely time to give up forming new orders and sub-orders, when Nature makes no such divisions. It is surely time that botanists enlarged their mode of treating their subject, and made some effort to approach it from a truly biological standpoint, and endeavoured to elucidate in some measure the ontogeny and phylogeny of plants.

It is surely time that fossil plants should find their way into a botanical text-book, and be treated with the care and attention which some of their modern representatives at present monopolise. If the botanist will not become a biologist, then the zoologist who has become one must relieve him of the task, and botanists must not complain if, through neglecting the advances made in the sister science, they find that Zoologists have entered their own field, and have done that which they were unable or unwilling to do.

Returning then to our original subject, I think we may enumerate other advantages still to be gained by the union of the study and teaching of extinct and living organisms; and not the least of these, it seems to me, is one which might not at first sight be considered an advantage.

At present, botanists and zoologists (for the word biologist is scarcely in use yet) are too apt to entertain the notion that details of physiology, of structure, or of embryology, are all-important, and that the broad general ideas on living things, and their relation to the inorganic world, as well as their interactions on one another, are useless, if not often pernicious.

A zoologist who, after proving in lectures on the Mammalia that man is a mammal, ventures to treat of man as a member of society, and extends biological methods to a treatment of the problem of human existence, ceases to be a zoologist in the eyes of a strict specialist. A botanist who talks about potential energy, of the relation of light and heat to the formation of complex organic compounds, and omits to mention whether the stamens of the Berberidaceæ are extrorse or introrse, runs the risk of being considered as a physicist or an organic chemist. Time is limited, and if a biologist felt himself compelled to devote a certain part of his time to a consideration of the problems of animal and plant structure and development in the past as well as in the present, probably a more philosophical view of organic nature would thus be obtained, at the expense, no doubt, of a large quantity of encyclopædic knowledge. I am one of those who think that the article is well worth having at the cost.

A wider conclusion, referring to scientific teaching in general, suggests itself at this point. I am strongly of opinion that the greatest danger resulting from the vast increase in knowledge during the past fifty years is the tendency toward specialism.

I am inclined to think that to advocate the isolation of the various departments of Natural Science is to advocate a retrogression in their philosophic treatment. I would advocate the union of Palæontology and Biology because that seems to me to be a more philosophic arrangement than to leave it in the hands of the geologist, who is, after all, a physicist in the wider sense.

But, on the other hand, I would not have the geologist ignorant of Palæontology. His training in that subject is rather to be considered imperfect until he has mastered the principles of Biology; just as the training of the Biologist is to be considered incomplete which omits a study of Geology, Physics, and Chemistry.*

We have far too little overlapping in our teaching, and far too much monopoly in research. In every subject the relationship of that subject to other departments of human knowledge ought to be clearly set forth and enlarged upon. Were this done to a far greater extent than it is, the burden of each succeeding teacher would be immensely lightened, and to the student himself the phenomena of nature would present themselves in an entirely new light. The sciences would then blend into one another, and continuity manifest itself where before all seemed disconnected.

This is neither the time nor the place to enlarge on such a topic, though one can hardly help seeing how the ignorance exhibited by many eminent specialists, the moment they cross the border of another science not absolutely involved in their own, the grossness of the blundering committed by students of such difficult subjects as Sociology and Ethics, all spring from the failure to appreciate the far greater

* "The palæontologist, however, can make no satisfactory progress in his special field of research, except in so far as he is equipped with a knowledge of existing organisms."—Dr. A. Geikie, F.R.S., Pres. Add., Roy. Phy. Soc., 1883.

importance of obtaining a comprehensive and philosophic grasp of all science than of attaining to an infinite degree of specific accuracy in one branch only. It is said that man has become what he is because he was gifted by nature with an opposable thumb. What that digit was and is to him, such a comprehensive and enlightened grasp of the relationship and interdependence of the various departments of Natural Science would be to the specialist.

Lastly, one word as to the practical study and teaching of Biology (including Palæontology), in the lecture-room, in the laboratory, and in the museum.

I fancy that there are not a few present who will agree with me in thinking that the comparative value of these three methods of teaching has not always been distinctly recognised. Allow me, in these concluding remarks, to indicate what I consider a legitimate use of these methods in such a subject as Biology.

Professor Huxley has most truly said that "the road to a sound and thorough knowledge of Zoology and Botany lies through Morphology and Physiology; and that, as in the case of all other physical sciences, so in these, sound and thorough knowledge can only be obtained by practical work in the laboratory."*

I for one certainly agree with that opinion expressed ten years ago by our leading professor of Zoology. In the laboratory the student, under the guidance of his teacher, ought to become acquainted with all the more important points in the morphology and physiology of recent forms, and with the peculiarities of the hard parts of extinct forms likewise. The frequent demonstrations and running commentaries made by the teacher during the hours of laboratory work should do away with the necessity for the rehearsal of the facts of anatomy and physiology with which lectures on

* Preface, *Elementary Biology*.

Biology are generally concerned, and would thus leave the lectures free to be made use of as a means of inculcating principles which cannot be treated of practically.

I would be inclined to look upon them as opportunities for example, for generalising on the work done during the laboratory study, and for indicating the general relationship of Biology to other sciences, and for explaining the etiology and affinities of the various classes and groups of the animal and vegetable kingdoms, in the past and in the present.

The museum ought to be so arranged as to be, in short, a silent lecture, or rather an abstract of all the lectures of the course. The placing of its cases, the selection of their contents, and the particular arrangement of these, ought all to be subject to the one central idea of Biology—the unity of plant and animal life in the past and in the present. For that purpose, the fossils which have so long lain virtually among the rocks in which they were originally discovered, must be transferred to the biological museum, and so placed in its cases as to show their true relation to their modern representatives.

I am happy to think that an attempt to reach this ideal has been made in the Free Public Museum of our own city. The attempt is good so far as it goes; but I cannot help considering this movement in what seems to me a right direction as incomplete so long as any fossils remain in the geological cases, away from their proper places in the biological cabinets.

In the present condition of these cases, an alteration of such magnitude is manifestly beyond possibility, at least at present.

To attempt to develope further any of the methods whereby what seems to me a much needed reform in biological teaching might be brought about, would be to digress even more grievously from the subject of this paper than I have already permitted myself to do.

THE CENTURY OF CALDERON.

By B. L. BENAS.

My paper this evening will be partly a criticism of the poems and dramas of Calderon and partly a historical reflection of the century in which he lived — the two subjects being inseparably interwoven with one another; if, therefore, it would seem in the course of my remarks that there is a digression from the main subject, it is because the works of Calderon are in a great measure the evolution of his century.

Archbishop Trench gives it as his opinion "that there are only three nations, in the western world at least, Greece, England, and Spain, which boast an independent school of dramatic poetry, one going its own way, growing out of its own roots, not timidly asking what others have done before, but boldly doing that which its own native impulses urged it to do; the utterance of the national heart and mind, accepting no laws from without, but only those which it has imposed on itself as laws of its true liberty, and not of bondage; so rich and so conscious of its riches that it did not care to beg or to borrow. The Roman drama and the French are avowedly imitations; nor can all the vigour and even originality in detail which the former displays, vindicate for it an independent position; Germany has some fine national plays, standing each of them isolated and apart, but no national dramatic literature; the same may be said of Italy."

I am inclined to think that there is much force in the Archbishop's opinion, and it seems somewhat strange that Calderon, who is idolised by forty millions of Spanish speak-

ing people with a greater enthusiasm than even we evince for our immortal Shakespeare, should be so little known to the Anglo-Saxon and northern races of Europe. Yet this is easily explainable, for, great as Calderon undoubtedly was, he never rose above the prejudices of the Spanish people—a people who, although undoubtedly clever, were not, neither are they now, educated or wise. I do not mean to infer that an educated people may always be possessed of wisdom or national tact. If national education means simply the inculcation of a limited amount of mechanical information, such as the imparting of the three R.'s, the dates of the principal historical events, the heights of the chief mountains, the lengths of the different rivers, the distances from the earth to the objects in the planetary system, then Great Britain, France, Italy, and Spain would rank much below Sweden, Norway, Denmark, Holland, or North Germany. There is no doubt that if a statistical comparison of illiterates were instituted between the different nations I have enumerated the apparent result would be undoubtedly in favour of the more northern people. Yet who would not maintain that Great Britain or France, even before the era of school boards, were, if not so well instructed a nation, certainly as clever in the aggregate as others better endowed with school teaching. It seems that people possessed of national tact are those that accept lessons from their own history, and turn even national disasters into beacon lights to warn themselves from similar catastrophes. For example, England has never had a repetition of the wars of the Roses, a family quarrel, where two branches of a dynasty almost ruined themselves and shed oceans of blood in order to settle their rival claims to kingship—the deposition of James the Second, and the revolt of the Pretender in Scotland were but feeble flickerings compared to the vast conflagration of rival interests of the Yorkists and Lancastrians. Nor has the

crown in England ever again been arrayed in arms against the people as Charles was with his parliament. Neither has the friction between the two houses of parliament, such as took place in 1832, ever been repeated; for the question which lately agitated the country for a few months, was less a question of principle than of procedure, the right of the popular will ultimately to decide never having been called into question. In France, since the reign of Henri Quatre, no two members of the same family have ever been arrayed against each other in arms. The religious ebullition of violence on the day of St. Bartholomew has never been repeated. The Revolution of 1792, with all its bloodshed, was carried on under a seeming cloak of legality. The Revolution of 1830 was roseate compared to the first upheaval; whilst the changes of Government in 1848 and 1871 hardly assumed greater proportions than those of a local riot.

If France has not altogether attained a consolidated popular government, coupled with respect for law and authority, it is because some of the causes which have for so long a period unfavourably influenced the social fabric of the Iberian Peninsula, though in a far less degree, are working their injury upon the French. Spain has, however, during the many vicissitudes she has undergone, only within the last few years emerged from a kind of national trance, during which period she has dreamed an existence of power, whilst other nations who have been awake and active have simply ignored her presence as a factor in the common work of international polity.

Don Pedro Calderon de la Barca, a man little known except to the few who have taken an interest in Spanish literature, was a dramatic poet, honoured wherever the Spanish language is spoken. Many of those who worship at his shrine place him upon a pedestal hardly below that of the great William Shakespeare; others there are, and these are

principally the French school of critics, who criticise him adversely, yet have not failed to plagiarize from his works. I venture to think that between those who worship Calderon with a fervid idolatry, and his Gallic detractors (who have even traduced Shakespeare), there is a middle path of high recognition—to use the words of the German Heine, "He is a poet by divine right, who attained the first firmament of poetry if he failed to reach the seventh heaven of dramatic literature."

Calderon was born at Madrid, January 17th, 1600, and died May 25th, 1681. To better suggest the epoch in which he lived in contemporaneous English history, let us be reminded that he was born when Queen Elizabeth was on the throne, he was an active military officer during the period coincident with James I, flourished as a dramatist contemporaneously with Charles I, that his literary labours co-existed with the rule of Oliver Cromwell, and that he closed his life long after the restoration of Charles II, almost at the termination of the Merry Monarch's reign. Calderon wrote about one hundred and twenty secular dramas, and something like seventy *autos*, plays dealing with religious subjects, besides a number of fragmentary pieces—this will show how difficult it is to deal with so prolific an author in a paper such as is presentable to a Society like ours. The Spanish writers were as a rule voluminous. Lope de Vega, his master and predecessor in poetic fame, wrote as many as fifteen hundred different pieces.

Spain was at that period the leading nation in the world; she had ships, she had colonies, she had commerce, far outstripping all her rivals. There was relatively as much difference in political importance, at the time just preceding Calderon, between Spain and Great Britain as there is at the present time between Great Britain and Holland or Sweden. The Iberian Peninsula was full of the great deeds of her

warriors, statesmen and poets, and the discovery of a new world by her navigators seemed for all time to secure for her the precedence among nations. All these sentiments vibrate through the pages of Calderon; he evidently writes with the consciousness that he is privileged to appeal to the greatest people in the world, one whose language was spoken from end to end of the globe, and upon whose rule and influence the sun had never set; in the words of the King, in his play called the *Great Theatre of the World*, he observes with conscious Spanish pride:—

> King of whate'er the sun illumines
> Of whate'er the sea enfolds—
> I am master absolute,
> I am the undoubted lord;
> Vassals of my sceptre all—
> Bow themselves where'er I go.
> What do I need in the world?

Calderon, like Goethe, Byron, and Tennyson, was born to a goodly heritage; his father was a gentleman of means, his mother descended from a Flemish family of good birth. Unlike some authors who have had to struggle for their existence, he knew nothing of pecuniary difficulties; his father was Secretary to the Treasury Board under Philip II and Philip III, hence he was not only in good circumstances, but possessed considerable political and social influence, and moved in the best society of Madrid. When Calderon described the amenities of ladies and gentlemen, when he revels in courts and courtiers, he did not draw upon his imagination for descriptive scenes, but simply recounted the life in which he lived and moved. His elementary studies he pursued at the Jesuit College at Madrid, and for five years after that he was a student of theology at the University of Salamanca; at nineteen we find him at Madrid without any fixed occupation. There are some traces of his

dabbling in poetry as early as 1620, but not until a few years later did he achieve anything appreciable. At the canonization of St. Isidore, the peasant saint of Madrid, we find in a trustworthy book of that period, called *Los hijos de Madrid*—the sons of Madrid, the following relating to some verses that Calderon composed on the occasion :—

This Calderon in his tender years has won laurels which time generally confers on grey hairs.

As was usual with young men of good social position in Spain, he joined the army in his twentieth year, and continued that career for ten years; he took part in the wars of Lombardy and the Low Countries. It is thought, from his graphic description of all the details in an early play—*The Siege of Breda*—that he must have been present at the taking of that fortress by Spinola, the celebrated Genoese warrior. To Englishmen this play will be interesting from the fact that Morgan, an English captain, who was amongst those entrusted with the defence of Breda, assisted by a small number of English and Scotch military adventurers, so common at that period, has been enthusiastically described by Calderon as a true hero, and as the soul of the defence of the vanquished fortress. This play is, however, one of Calderon's earliest and weakest. His military life seems to have given him great dramatic fervour, for during that period, no doubt in the leisure of the camp—for wars and sieges were terribly tedious in former centuries, and the area of combats more circumscribed than in our days, he must have had ample time—some of his best plays, *The Fairy Lady, The Physician of his own Honour, It is better than it was, Life's a Dream,* were composed. During the time that Calderon was with the army his plays were being performed at the Madrid theatres, and all classes of the people were carried away with enthusiasm. When he was but

thirty years of age, Lope de Vega, until then the greatest dramatic writer of Spain, recognised Calderon as his equal and his successor; and in 1635, when De Vega died, Calderon was by common consent placed on the vacant poetic throne. Philip IV, who was a passionate admirer of the drama, ordered Calderon back from the wars and conferred upon him the office of Intendant of the Court Theatre, a similar position to that which Goethe occupied at Weimar. The King was most desirous to prevent the poet continuing his career of arms, for the fate of Garcilasso was in his mind. This young and highly-gifted poet, who died in early manhood leading a forlorn hope, was felt to be an irreparable loss to Spain; it was, therefore, thought wise to use every inducement to keep Calderon from meeting a similar fate; he however stipulated, so it is reported, to remain with his comrades in arms until peace was concluded. Calderon then entered fully into his duties as Court Poet and Dramatist, and for all royal festivities and masques his poesy was in constant request. On the occasion of King Philip's second wife, Anna Maria of Austria, arriving in Madrid, he wrote *Beware of Still Waters*, wherein the pomp and royal circumstance of the marriage and pageant was made much of. In 1651, he took a step in life which in England might seem incongruous with his occupation, but in Spain was accepted as a matter of course, Calderon entered into holy orders, became a priest, and was appointed Knight of the Order of Santiago, and Chaplain to the Chapel of Kings at Toledo, and never until the close of his life, on Whit Sunday, May 25th, 1681, his years being parallel with those of his century, having been born in 1600, did his literary activity cease, nor did his popularity ever diminish. He was interred in the parish church of San Salvador; and in 1840, his remains were removed with considerable pomp and solemnity to the church of Our Lady of Atocha, a kind of Spanish West-

minster Abbey. On that occasion, Zorilla, considered the best modern poet of Spain, composed his *Apoteosis de Don Pedro Calderon de la Barca.*

In May, 1882, great festivities took place at Madrid in commemoration of Calderon's bi-centenary. For many months previously Madrid had been anxiously preparing for the festival in honour of her great poet. Invitations were scattered broadcast through Europe, and poets of all nations were invited to compete in prize odes and essays on Calderon and his works. On the 22nd of May numerous literary meetings were held, a monument unveiled, and banquets, concerts, and lectures innumerable were given, while Calderon's plays were performed at the theatres. On the 25th, the anniversary of Calderon's death, a solemn service was celebrated in the Church of San Jose, the King and all the celebrities of the capital being present, and after the Mass had been said, a procession was formed which wended its way to Calderon's tomb. Next day there was another procession of some eight or nine thousand youths; but on the 27th, there was a grand historical cavalcade which certainly formed the greatest feature in the whole proceedings. This comprised, in addition to deputations from every Town Council, guild, literary, commercial, and official corporation in the kingdom, a number of triumphal cars, allegorical statues on platforms drawn by horses, and soldiers in the uniforms and with the arms of the seventeenth century. A newspaper correspondent tells us it seemed as if the contemporaries of Calderon had sent some 2,000 dignitaries and citizens of the Madrid of 1681 to parade the streets with the modern promoters of the centenary festivities.

To illustrate the genius of Calderon, I will bring before you one his finest historical plays, a drama for which Goethe

and Shelley have expressed their intense admiration. It is entitled *The Constant Prince*. It treats of a war, one of many which Portugal engaged in with the Moors on the African coast. In one of these campaigns Prince Ferdinand, by the way, grandson of our John of Gaunt, was taken prisoner by the King of Fez, and was offered his liberty on condition that the then Christian city of Ceuta should be surrendered to the Mahomedan king as ransom. To this the prince, like Regulus, the old Roman captive in Carthage, refuses to give his consent. With the main plot of the drama there is also an underplot, similar to those of the Shakespearian historical plays. The daughter of the King of Fez, a beautiful Moorish girl called Princess Phœnix, is beloved by Muley, nephew of the king and general of the army, whose love is reciprocated. Muley, the Moor, was at a previous period captured by the Portuguese, and was set free by this very Prince Ferdinand who is now a prisoner of his uncle the king.

In the first scene we see the princess taking her airing in the royal gardens of Fez, listening to the distant songs of Christian captives who are working their period of servitude, and whose chains are clanking in time to their voices. Her maid bids the captives continue their strains, "for," observes she, "our good princess doth love to hear the dulcet melody of sweet song." They are, however, soon dismissed, as the king now enters and tells his daughter that he has promised her in marriage to the King of Morocco. This is heartrending tidings, to Muley, but they are both suddenly informed that the Portuguese have effected a landing, and that their armies are in full march against the Moors. All sentiment is at once dismissed, and both king and general hasten to the front, and we now enter upon the main plot of Calderon's drama. On the Portuguese landing on the shore, Prince Henry, brother to

Ferdinand, happens to meet with a fall. The Christian warriors take this as an evil omen, but the brave Ferdinand cheers them thus:

These common portents and these terrors vain
Come to win credence from our Moorish foes,
Not to dismay the Knights of Christ's own train;
We two are such. Not here in fight we close—
From vain desire of proud memorial—
That in the scroll of history brightly shows,
When human eyes upon the record fall;
The faith of God we come to magnify.
His be the honour, his the glory all,
If we with good success shall live and die:
Fearing God's chastisements men fear aright,
But no vain terrors wrap them when they dart;
We come to serve, not trespass in his sight,—
Christians ye are, as Christians act your part.

But under-estimating the forces of the Moors, and venturing with too small an army, the Portuguese are utterly routed; and whilst performing heroic feats of valour, Prince Ferdinand is captured and brought in triumph before the King of Fez. The king receives the Christian prince with every kindness and courtesy due to his high rank, and despatches a message to the King of Portugal, offering to set the prince at liberty, and demanding as his ransom the city of Ceuta. King Edward, dying with grief at the report of this disaster, with a last effort signs a document granting the Moorish king's request. Prince Henry appears with this treaty before the King of Fez, and here the dramatist works a most powerful scene. Everything is expected to end well, but Prince Ferdinand—a Christian Regulus—refuses his liberty at such a price. He cannot, and will not, sacrifice a city won by his country's best blood; nor can he, as a true believer, allow its churches to be converted into mosques. He tears the treaty into fragments, in the pre-

sence of the Moorish king, and prefers to remain a slave rather than gain his freedom at such a cost. The King of Fez fumes and raves at this unlooked for attitude, and exclaims, "How dare you keep the city from me?" "Because," replies the prince, "it belongs to God, and not to me."

The next act brings us into a Moorish garden, for Calderon revels in tropical verdure, where blue skies and gurgling waters, bright sunshine and luxuriant foliage intermingle with one another. Prince Ferdinand hoped for a martyr's death, trusting the axe would swiftly send him to heavenly realms. But this the Moorish king had not intended; he would keep him an abject slave, loaded with chains, working amid a party of the lowest giaours, eating his heart gradually away; the Moor being sustained by the hope that the prince would eventually yield him the price of his ransom. But the prince works on. In this garden, in chains, he meets the Princess Phœnix, with an attendant. The princess speaks to her maid of a curious prophecy uttered at her birth, namely, that she should be the price of the ransom of a corpse. "Who can this dead man be, of whom I am to be the price?" asks the princess. Prince Ferdinand overhears this question, and cutting a flower, offers it to the princess, saying, "I bring you in this flower the emblem of my fortune." The princess listens with evident sympathy to the slave whom a little time before she saw, in all the pride of a cavalier, at her father's court, and whom now she recognises in the wan, pallid, and suffering bondsman. The captive prince hands her the flower with these words:

> These, which to greet the day's first splendour waking,
> Arose in gladness and in exultation,
> Shall be at eve vain grief and lamentation.
> In the cold arms of night their last sleep taking.
> These tints that *challenge heaven*, new rainbows making

Of ordered gold and snow and deep carnation,
Shall teach us much, in one day's brief duration,
Our brittle life with warning terrors shaking;
For as the roses early rise to bloom,
But, as they bloom, old age comes on apace,
Till in one bud they cradle find and tomb—
Even such like fortune waits the human race,
In one day to be born and die their doom;
For hours and ages past leave self-same trace.

The next scene brings together two different types of high-souled human beings—Muley, the young Moorish captain, and the captive prince. Muley cannot forget that he owes his life to Prince Ferdinand, and endeavours to indicate to him some means of effecting his escape from horrible servitude. He offers to give him the keys of his dungeon, have a bark ready so that he can swiftly reach the other shore, and that the king would at worst only suspect the guards. The Christian prince refuses, for why should suspicion fall unmerited upon others. Then the Moorish captain rises to a height of chivalry; he offers to remain in the dungeon, allow the prince to obtain his freedom, and surrender his life in exchange for that of the escaped Christian prince. This Ferdinand declines, as it would involve Muley in treachery to his sovereign; he prefers captivity, and will retain the title of "The Constant Prince." Muley once more hastens to the king, and entreats him to accept the untold sums of gold that Portugal offers for the ransom of her prince. "Ceuta, or nothing," replies the monarch. To add to poor Muley's sufferings, he is ordered by the king to escort the Princess Phœnix to her affianced bridegroom, the King of Morocco. In the meantime, Portugal has been making great efforts to relieve Prince Ferdinand by force of arms. This redoubles the cruelty of the King of Fez towards his captive, so that Prince Ferdinand implores the

king to grant him death. In a very fine speech, much too long for our dramatic taste, he asks the sovereign to heed his suit, for magnanimity to a fallen foe is one of the bright jewels of a royal crown. Animals have royal characteristics, how much the more human beings. The lion tears not the unresisting; the eagle prevents a traveller from drinking a poisoned fount; a dolphin has saved a shipwrecked mariner; the pomegranate, queen of fruits, gives warning when envenomed by turning pale. What pity, then, may not a monarch among men extend to a suppliant? The prince asks not life; it is death he implores. He concludes with something reminding us of King Lear:

Vent on me thy fiercest rage,
Since though hotter grow my torments,
Sharper yet these cruel pains,
Fiercer yet on me thy rigours,
Me, though yet worse miseries waste,
Though I yet worse hunger suffer,
Ragged, stript of raiment bare,
Though I lie midst dust and ashes,
Firm I still cleave to the faith;
For it is the sun which lights me
(Light that points my course out plain),
And my Victor's crown of laurel;
Thou shalt no proud triumph take
Oe'r the Church! If such thy pleasure,
Oe'r *me* triumph, here abased;
God will rise, my cause maintaining,
For 'tis His that I maintain.

The king replies:

Canst thou boast, and consolation
In thy very sufferings find?
How, then, speak my condemnation,
If they stir not my compassion,
Rousing none in thine own mind?

Since thy death from thine own hand
Comes, and not from my command.
Hope not any help from me—
Pity first thyself, then see
How I pity!

But the already weakened frame of the captive prince, exhausted in his appeal to the king, is no longer able to totter further, and the death he prayed for at the hand of the king comes unasked from heaven. He tells a fellow Christian slave in dying words:

Noble Juan, hear one last
Prayer; 'tis this, when death is past,
Strip me of this raiment old,
Fetching from our hut, unrolled,
My great order's cloak, by me
Borne through long years faithfully.
Bury me wrapped in its fold,
Face unveiled; should pityingly
Softened the king's wrath endure
That I here find sepulture—
Mark my grave, for hope have I
That, although I captive die,
I shall ransomed be one day—
Where, by altars, priests can pray;
For since I, my God, to Thee
Many churches gave, to me
One I know Thou wilt repay.

The last act is full of life and animation. The Portuguese troops are hastening to the relief of the Christian hero, hoping to find him yet alive. The King of Fez, baulked by the death of the prince of the city of Ceuta, upon which he had set his heart, refuses to give the body burial. Just at this moment the Portuguese troops are at the walls of Fez, and during their march have captured both the King of Morocco and the monarch's daughter, Princess

Phœnix. Trumpets sound for a parley; King Alphonso demands Prince Ferdinand's release, else the beauteous Phœnix will be put to death before her father's eyes. The King of Fez hesitates, and reproaches are heaped upon her father's head by the princess.

"Nay," the king her father replies—

It is not that I would not grant thy life, sweet daughter; it is mine that the stars are conspiring to take from me by slaying thee. For know, King Alphonso, that the exchange thou proposest is no longer in my power. This coffin holds all that is left of the prince. Kill my beauteous Phœnix, and let my blood pay for thine. I shall die myself soon after.

"Not so," is King Alphonso's magnanimous reply—

King of Fez, lest thou consider
That dead Ferdinand in value
Weighs less than this living beauty
I for his dear corpse exchange her.
Send me, therefore, snow for crystals,
January for May the radiant,
Withered roses for thy diamonds,—
Yea, send death for beauty rarest.

Thus the prophecy becomes fulfilled, that Princess Phœnix becomes a ransom for a corpse. The King of Portugal, as he delivers her to the King of Fez, pleads for her marriage with the faithful Muley, whilst the Christian captives are set free, bearing the hallowed remains of "The Constant Prince," to be treasured as cherished relics in their cathedral, mingling gladness with tears in reverent homage to the martyr prince.*

No record of Calderon would be complete without a mention of his *Magico Prodigioso,* a subject which seems to be a favourite one with great poetic minds. Milton is immortalised by his *Paradise Lost,* so is Dante by his *Divina*

* Hasell.

Comedia; Byron has touched upon the weird in his *Manfred*, and Goethe evolved his *Faust* from the thoughts and experiences of a lifelong thought. Calderon in his *Magico Prodigioso* has likewise struck a sympathetic chord on the same lyre. He has produced a fine tragedy dealing with the influence of good and evil upon a highly-refined and sensitive mind; and has endeavoured to bring into conflict the rival seductions of mental and material gratifications. Shelley has given some admirable translations from this tragedy, with all the deep feeling of this grand erratic English poet. The speech of the Demon is very fine, reminding us of Milton:—

Since thou desirest I will then unveil
Myself to thee; for in myself I am
A world of happiness and misery;
This I have lost, and that I must
Lament for ever. In my attributes I stood
So high and so heroically great,
In lineage so supreme, and with a genius
Which penetrated with a glance the world
Beneath my feet, that won by my high merit.
A King whom I may call the King of Kings
Because all others tremble in their pride
Before the terrors of his countenance.
In his high palace roofed with brightest gems
Of living light (call them the stars of heaven),
Named me his counsellor. But the high praise
Stung me with pride and envy, and I rose
In mighty competition, to ascend
His seat, and place my foot triumphantly
Upon his subject thrones—chastised, I know
The depth to which ambition falls! Too mad
Was the attempt, and yet more mad were now
Repentance of the irrevocable deed;
Therefore I chose this ruin with the glory
Of not to be subdued, before the shame
Of reconciling me with him who reigns
By coward cession.

How contradictory it seems, that there was an evident sympathy in thought between Calderon and Shelley, this is all the more strange inasmuch as the Spanish poet was thoroughly Catholic, whose whole aim and object was to glorify the Church. Schlegel, the German poet and critic, writes:—"In every situation and circumstance Calderon is of all dramatic poets the most Christian. He would dare to touch upon the most difficult problems that agitate the human mind—the objective aims of human existence, the why and wherefore of human suffering, whether this planet is the be all and end all of creation, yet Calderon generally winds up his speculative theories much as a subaltern whose only duty is to fight the enemy and obey, he seems quite certain that the chief of the staff and the council of war know what they are aiming at, and although he forsees difficulties immeasurable, he never doubts the invincibility of the flag under which he has enlisted." The point of contact with Shelley seems to be that he appreciates the difficulties and mysticism of the Spanish poet, but has no such confidence in the sovereign puissance of his comrade's leaders. How deeply Shelley was imbued with Calderon's weird imagery the following story which Lord Byron related to Captain Medwin shows:—

> Shortly before his fatal voyage to Leghorn, the inhabitants of the country house at San Lorenzo were alarmed at midnight by piercing shrieks. They rushed out of their bedrooms, and found Shelley in the saloon with his eyes wide open, and gazing into vacancy as though he beheld some spectre. On waking him, he related that he had had a vision. He thought that a figure wrapped in a mantle came to his bedside and beckoned to him. He got up and followed it; when in the hall the phantom lifted up the hood of his cloak, showed Shelley the phantasm of himself and saying "*siete satisfatto*" vanished.

Shelley had been reading a strange drama by Calderon, entitled *El Embozado o' el Encapotado.*

The story is that a kind of Cipriano, or Faust, is through life thwarted in all his plans for the acquisition of wealth, or honour, or happiness, by a masked stranger, who stands in his way like some Alastor, or evil spirit. He is at length in love, the day is fixed for his marriage, when the unknown contrives to sow dissension between him and his betrothed, and to break off the match. Infuriate with his wrongs, he breathes nothing but revenge, but all his attempts to discover his mysterious foe prove abortive; at length his persecutor appears of his own accord. When about to fight, the Embozado unmasks, and discovers the phantasm of himself, saying, "Are you satisfied." The hero of the play dies with horror.

This drama had worked strongly on Shelley's imagination, and accounts for the awful scene at San Lorenzo.

In another tragedy, the *Mayor of Zolamea*, Calderon so much resembles Shakespeare in Polonius' advice to his son that I venture to give you the lines :—

By God's grace boy, thou comest of honourable if of humble stock; bear both in mind, so as neither to be daunted from trying to rise, nor puffed up so as to be sure to fall. How many have done away the memory of a defect by carrying themselves modestly; while others again have gotten a blemish, only by being too proud of being born without one. There is a just humility that will maintain thine own dignity, and yet make thee insensible to many a rub that galls the proud spirit.

Be courteous in thy manner, and liberal of thy purse; for 'tis the hand to the bonnet and in the pocket that makes friends in this world, of whom to gain one good, all the gold the sun breeds in India, or the universal sea sucks down, were a cheap purchase. Speak no evil of women. I tell thee the meanest of them deserves our respect; for of women do we not all come? Quarrel with no one but with good cause; by the Lord, over and over again when I see masters and schools of arms amongst us I say to myself, "This is not the thing we want at all—*how* to fight—but *why* to fight, that is the lesson we want to learn—and I verily believe if but one master of the *why to fight* advertised among us, he would carry off all the scholars.

From the examples of Calderon's writings we may now proceed to see the points of strength and likewise the weakness of his compositions. His works reflect with striking exactness the very character of the Spanish people, moulded as it has been by a variety of external and internal influences. It will be perceived that his dramas are intensely national and at the same time religious, thus vibrating with the pulsation of the popular feeling of Spain. We entirely miss the splendid individuality of character which Shakespeare's heroes and heroines possess. Hamlet, Othello, Iago, Romeo, Benedict, Orlando, Macbeth and Falstaff are each separate and distinct individualities, and actuated, each of them, by a different code of morals; they act their own lives and they speak their own words.

Calderon's language, it must be admitted, is superb and full of poetic imagination, yet all his heroes and heroines are, if I may so term them, Calderon's marionettes; you feel they have no action of their own, and it is the poet himself who is speaking. All his good characters have the same line of virtues, all his shady characters have identical failings, so that having read one drama, however much the language may differ, you are well aware how the drama will culminate.

I have advisedly given the thread of the *Constant Prince*, dealing as it does with two different races and religions. In a purely local Spanish play, dealing entirely with men of one religious thought and one nationality, Calderon's heroes lie and cheat, are unmindful of the seventh commandment, they are nevertheless good churchmen, courteous and well bred, always prepared to die for the faith, and generally wind up in the odour of sanctity. From Calderon's point of view no possible virtues could atone for the fact of being a heretic, but given the two cardinal points, loyalty to the sovereign and fidelity to the church, the ultimate

chances of reserved seats in Paradise seem beyond all doubt.

Calderon never rises superior to the aspirations of the people among whom he lived. If it was half hinted during the latter period of his life that Spain was not the dominant country she used to be, and that foreign nations were beginning to treat without her, the Spaniard would wrap himself up in his peninsular pride and reply, "we don't care for the foreigner," that is our Spanish mode of conducting affairs. The cause for this is not far to seek. When Spain was inhabited by several millions of Arabs the political division was a very abrupt one, even after the last Moorish king was dethroned and the government of Spain became entirely homogeneous under Ferdinand and Isabella, the traces of the long conflict between the two races for supremacy left many evil influences. Whilst the conflict was raging for centuries it was not asked of a Spaniard how he conducted himself socially or morally, but simply whether he had fought against the Moor, the finer gradations of character were entirely obliterated in the one great common object. Unlike the Mahomedan Turk, who is not amenable to civilising instincts and averse to all learning, and whose sole delight is war, the Hispano Arabs had made considerable strides in culture, the very terms that have come to us from them, namely, alchemy, algebra, zenith, nadir, our numerical symbols, known as the Arabic numerals, show that they cultivated science, whilst the beautiful remains of the Alhambra abundantly testify that their constructive art was of a high order. Our modern paper made of rags is an Hispano Arabic invention. Their Schools of Medicine and Universities in Granada and Cordova were filled with students of all creeds, so that intellectually at one period in Spain, there was little to choose between the Iberian and Arab. Ethnologically speaking, although the Biscayan Spaniard

is Celtic, and some of the northern provinces are tinged with the Gothic element, there is a vast substratum of the early Phœnician race which at one time covered the entire peninsula, and this blood forms no inconsiderable portion of that which flows in his veins. The Romans left the impress of their language much more than that of their race; the lingering fondness for the bull-fight, so often attributed to the Roman arena, in reality was a Phœnician, Syrian, and Carthaginian pastime rather than Roman; the great festivals in honour of the Phœnician deity, Bel or Baal, were always accompanied by combats with, and slaughtering of bulls. That the Arab is able to live and prosper side by side with European civilization is proved in Algiers, where the native is happier and more prosperous than ever he was under the rule of his native chiefs. In Malta the native population is decidedly Arab, though not Mahomedan; and the Maltese when they emigrate, proceed rather to Tunis, Algiers, and Morocco than to Italy. Spain, however, at the close of the fifteenth century endeavoured to accomplish that which is generally fatal to all nations—instead of seeking union she sought *uniformity*, and in attempting this she crushed out all individuality of character. Nature is full of union and harmony, yet there is little uniformity; there are no two faces absolutely alike, no two trees identically resembling one another, no two grains of sand nor two atoms that are positively the counterpart of each other. When communities wish to effect that which nature never intended to effect, namely, uniformity rather than union under given laws, it is not difficult to foresee that failure will be the result. Cardinal Ximenes, the great Prime Minister of Ferdinand and Isabella, attempted to accomplish for Spain that which has proved to be a political impossibility. His great aim was to admit no discordant elements in the Spanish empire, and to reduce all thought to a dead level of

oneness. If this object were at all attainable Ximenes was the very man to have successfully accomplished it. He was of unimpeachable moral character, utterly incorruptible, who gave his own fortune to the state rather than receive any reward. His learning was of the most profound character, and he was in his youth an intellectual gladiator in the University of Salamanca. It was by his encouragement that the New World was opened up to Europe, and his long life and experience in diplomacy gave him a commanding position in the council of nations, whilst an herculean physique enabled him to perform unwearied laborious offices of State without any symptom of fatigue. When above threescore and ten he would travel hither and thither in Spain, seeing that his orders were carried out, rather than rely upon the reports of his commissioners. The nobility of Spain had until his period enjoyed considerable privileges, and occasionally manifested a sympathy with the Albigenses and Lutherans, and rather a restive spirit against the power of the Church. The great mass of the people on the other hand, were unflinching advocates of the supremacy of the Church. Whilst the nobles were prepared to effect a compromise with heretics and Moors; allowing a toleration of their belief or unbelief providing they worked for the common national welfare, the masses were uncompromising in demanding their expulsion, and as the clergy were to a great extent recruited from the rank and file of the population, the interests of the two classes were coincident. The majority of the Moors, of whom there were about three millions, were patient tillers of the soil, were contented and easily governed, drank no wine, were a reliable and steady peasantry, and as such were valuable on the estates of the Spanish grandees. The Jews and heretical nonconformists were the most successful merchants, who, by dint of finding good markets for the produce of the soil, and by the importation of manufactures

from distant lands, both benefited the country and enriched themselves. The great masses of the Spanish populace, however, only saw hated rivals, who if ejected would make room for themselves. Cardinal Ximenes chose to ally himself with the popular element, and was therefore revered with an almost enthusiastic idolatry by the people. He broke the neck of the patrician element by the expulsion of all Moors, Jews and heretics, thus the landowners found themselves at once deprived of their peasantry, and of the merchants who disposed of their produce to good advantage. He favoured the Inquisition, which was originally rather a political than a clerical engine; it was an organisation formed throughout the length and breadth of Spain, the Low Countries, and all her colonial possessions, and no one could obtain office under the State in any capacity whatsoever, whether municipal or imperial, unless he bore the official recommendation of the Inquisition.

This was Cardinal Ximenes' master-stroke of policy. All independence of thought or action was crushed out of existence, and the result was a stereotyped code of morals and national thought from which no one dared to swerve one hair's breath under fear of the penalty which the Inquisition meted out to the refractory.

Thus we see why Calderon inherited a stilted and artificial poetic style, instead of the rugged beauty and natural freshness which breathes life into every one of Shakespeare's creations. Goethe observes that Shakespeare's Roman characters were all Englishmen, but why should they not be? for, adds the great German critic, are not Englishmen hereditary freeborn men with instincts of true national and individual liberty, and what else, asks he, were Romans in their palmiest days of civic greatness?

Spain never recovered from the policy of her great Cardinal Ximenes. For a time all seemed roseate, and the

confiscation of so many estates, and the acquisition of lands at nominal prices by the people, gave them a false prosperity for a brief period, very much like an individual whose house has been destroyed by fire, and who, having acquired the proceeds in cash from the insurance office, goes on spending in extravagance the money he has suddenly acquired without thinking of reconstructing the destroyed edifice. He eventually finds in time that he has dissipated his capital, and has nothing left to replace the lost house. So it was with the Spanish peasantry, whose constant craving was to possess the land as their own instead of working for wages. When they obtained the confiscated estates of the nobles and ejected heretics at the hands of the government, through the instrumentality of the Inquisition, they found themselves ultimately in a greater state of poverty than before their wages ceased; they had no necessity to work for landlords, some of them vegetated on their lands in a state of idleness, others emigrated to the New World, where they could force the natives to work for them, and thus re-enacted, though in a much harsher and more cruel form, the very system from which they implored Ximenes to relieve them at home. The most fertile and productive estates in Spain were utterly ruined and neglected, and whole provinces for nearly two centuries were left almost without inhabitants. Well would it have been for Spain had her great leader Ximenes possessed some egregious failings, he might then have encountered national opposition; his failings were at worst errors of judgment, all his intentions were formed from the best of motives; but, notwithstanding he sowed the seeds of national decay, yet in consequence of his undoubted piety, his erudition, his abnegation of self, his unflinching advocacy of the popular cause as opposed to aristocratic privileges, all these gave a sort of sanctity to his political ruling—to dare to oppose which during his lifetime was deemed an absurdity.

Yet facts are stubborn things; and whilst Ximenes' policy outlived him for more than two centuries, there never arose an individual among his successors above whom Ximenes did not tower head and shoulders.

The century of Calderon had inherited some of the glories of Spanish greatness. Archbishop Trench observes on the Spanish national decay, "It was well at least for her poets and her painters that for them it was still possible to hide this from their eyes. A very little later, when the symptoms of her rapid decay became more numerous, and also more evident, so that even these could not have missed them, it would have been impossible for a great poet to have arisen in Spain. For a great poet, without a great country, without a people to be proud of, and which he feels shall in return be proud of him, without this action and reaction, never has been and never can be. Elegant and even spirited lyrics, graceful idyls, comedies of social life, with all the small underwood of poetry, can very well exist, as they often have existed, and even thriven, where there is little or no national life or feeling; but the grander or sublimer forms of poetry, epos and tragedies, and the loftier lyrics, can grow out of, and nourish themselves from, no other soil than that which a vigorous national life supplies. Had Shakespeare's prophetic eye already caught a glimpse of this when he speaks of one as coming: –

"From tawny Spain lost in the world's debate."

Lowell, the American writer, and at present ambassador to this country, has the following lines on Calderon, with which I conclude :—

O music of all moods and climes
  Vengeful, forgiving, sensuous, saintly,
Where still between the Christian chimes
  The Moorish cymbal tinkles faintly.

O life borne lightly in the hand
  For friend or foe with grace Castilian,
O valley safe in Fancy's land,
  Not tramped to mud yet by the million.

Bird of to day, thy songs are stale
  To his, my singer of all weathers,
My Calderon, my nightingale,
  My Arab soul, in Spanish feathers.

THE COMPARATIVE ETHICS OF ANCIENT RELIGIONS.

" *Verba docent*, EXEMPLA *trahunt*."

BY HENRY LONGUET HIGGINS.

IT has been usual, in tracing the history of Ethics, to follow something like the following course:—First, an account is given of so-called "Pagan" ethics, meaning thereby the moral teachings of certain Greek and Roman philosophers. Next, the ethical principles of Christianity are discussed, and their influence on mediæval and modern life and conduct. And, lastly, we generally find a description of modern English and German ethical theories, including certain recent attempts to base a system of morals upon a foundation of science. With the exception of course of Christianity, it is surely remarkable that little or nothing is said, by most writers on ethics, of the moral teachings of those vast systems of belief and practice which we term the great Religions of the world, and which have exercised so profound an influence on the intellectual and moral progress of mankind. Their influence has indeed, as regards something like two-thirds of the human race, arrested that progress at a certain stage, and rendered further development almost or entirely impossible.

Our general views of the moral progress of mankind have, I think, suffered from this limitation of the field of enquiry. The results obtained from the study of Greek and Christian ethics need extension and correction by the application of that Comparative Method which we have lately applied, and with such wonderful results, to the study of religion and

language. The science of Comparative Ethics is as yet in its infancy, and one of its chief branches will certainly deal with the moral teachings of Ancient Religions.

In considering the moral history of mankind we find two very remarkable features. These are (1) the unconscious development or progress of national morality, and (2) the influence exercised upon that development by moral rules, chiefly embodied in systems or codes of conduct, whether philosophical, legal, or religious. Let us consider these in order.

(1). The intellectual progress of mankind has been too palpable to be questioned. But with respect to *moral* progress, the case is not quite so clear, and it has been constantly denied that there can be any principle of progress in morals. There is, in fact, a very curious unwillingness, on the part both of men and nations, to admit the fact of their moral improvement.* Yet nothing is more certain than that an unconscious development of morality is, among the progressive races of mankind, constantly taking place. According to Mr. Lecky, † the moral historian is chiefly concerned with changes (1) in the moral *standard*, *i.e.*, the degrees in which in different ages, recognised virtues have been enjoined and practised, and (2) in the moral *type*, *i.e.*, the relative importance that in different ages has been attached to particular virtues. We are now chiefly concerned with the influence exercised over this moral development by rules for the conduct of life, more or less systematically drawn up.

(2). The dawn of Rules of Conduct is found in the ancient maxims and proverbs which form part of the earliest

* Maine, *Ancient Law*, pp. 70, 306.
† *History of Rationalism in Europe.*

traditions of most nations. Such are the maxims of the "Seven Sages" of Greece, referred to and quoted by Plato. "Even Aristotle, more than 2,000 years ago, could speak of proverbs as 'the fragments of an elder wisdom, which on account of their brevity and aptness, had, amid a general ruin, been preserved.'" * Still more venerable are the Egyptian "Maxims of Ptahotep," whose author, writing about 3,000 years B.C., tells us that his desire is to instruct the youthful in *the wisdom of antiquity*. What a glimpse along the corridors of Time! Many of Ptahotep's precepts are so full of high morality that they must be the result of a long national progress in civilisation.

Later on, we find moral rules gradually becoming collected and systematised, generally in connection with some school of philosophy, of law, or of religious belief. Thus arises the most important of all influences on the unconscious growth of national morality, viz., that of more or less systematic bodies of ethical teaching. These are of three principal kinds:—philosophical, legal, and religious, as shewn in the table on the following page.

I. *Philosophical Ethical Systems.*

The most conspicuous instances of philosophical schools which endeavoured to carry out their principles in actual daily life and practice are (1) those of ancient Greece and (2) those of India.

The chief distinction between these Western and Eastern societies is that the Greek schools were hardly or not at all connected with the national religious belief, while the Indian schools were an outcome of the more profound speculations of Hinduism. The effect of race and climate is seen on comparing the Western with the Oriental schools. The Greek were active and practical, and laid down rules for the conduct

* Trench, *Proverbs and their Lessons*, p. 29.

			EXAMPLES.
The chief sources of ETHICAL RULES or TEACHINGS are—	I. PHILOSOPHICAL SCHOOLS	(*a*) Purely secular	Stoicism.
		(*b*) Sectarian or quasi-religious	Pythagoreanism. Epicureanism.
		(*c*) Purely Religious . . .	The Hindu Schools of Philosophy.
	II. LEGAL CODES . . .	(*a*) Purely secular . . .	The Roman Laws of the XII Tables.
		(*b*) SACRED	Law of Manu. The Mosaic Law.
	III. RELIGIONS	(*a*) Theological systems of little or no ethical value	Savage Religions. Brahmanism.
		(*b*) Ethical systems without true Theological Belief	Confucianism and Taouism. Buddhism.
		(*c*) Mixed systems of Theology and Ethics . .	Mahometanism. Zoroastrianism. Christianity.

of life, thus supplying the absence of any ethical teaching in the national religion. And some of the Greek philosophers were so dogmatic—even prophetic—in the announcement of their teachings that their disciples almost formed *sects* rather than schools. The phrase αυτος εφα, *ipse dixit,* was attributed to Pythagoras. The Epicureans also were remarkable for their unquestioning acceptance of the "dogmas" of their Master, whose last charge is said to have been -των δογματων μεμνησθαι.

On the other hand, the Indian schools are poor in ethical interest. For the one great aim of Brahmanical philosophy "is to teach men to abstain from action of every kind, good or bad, as much from loving as from hating, and even from indifference. Actions are the fetters of the embodied soul, which when it has shaken off, it will lose all sense of individual personality and return to the condition of simple soul. . . . This is the only real bliss—the loss of separate identity by complete absorption into the supreme and only really existing Being, who is wholly unfettered by action, and called *sac-cid-ananda,* because he is pure life (with nothing, however, to live for), pure thought (with nothing to think about), pure joy (with nothing to rejoice about)." * From such teaching as this no moral code worthy of the name could ever arise. On the other hand, we find among the Greek systems the highest pitch of excellence that any ethical code is capable of which is not based on the fundamental principles of the Christian ethics—rightness of *motive,* universal charity, and the imitation and devoted love of a perfect Example,—an ideal Life. Their chief defect was the absence of any higher *sanction* than that of the wise men or philosophers who founded them; their precepts not being enforced by either the civil authority on the one hand, or religious belief on the other. But they shew us that

* Monier Williams, *Hinduism,* p. 52.

wherever a religion fails to satisfy spiritual or ethical needs, schools of philosophy spring up to take its place and become a Rule of Life.

II. *Legal Ethical Systems.*

The earliest legal codes we are acquainted with are among the most valuable intellectual relics of antiquity, for they have preserved to us precious fragments of the ethical thought of mankind in the morning of the world. Amongst purely legal codes we possess part of some very ancient Babylonian laws, and the Roman Laws of the Twelve Tables. Even more interesting than these is the celebrated Indian law-book of Manu, which belongs to a period when Law was gradually disentangling itself from Religion. This work is to this day reverenced throughout India as scarcely less divine than the Veda itself. It forms a fitting introduction to the subject of *Sacred Law*, which has exercised so vast an influence on mankind. Our modern conception of Law as a civil institution, quite distinct from Religion, is so firmly fixed in our minds that we can hardly be too strongly reminded that in the early history of mankind legal and religious rules are the same, or so closely blended that they cannot be separated. In technical language, there is at that period no distinct legal *sanction* as distinguished from the religious. Hence, the Indian law books are chiefly so called because they contain precise codes of *rules of conduct.** The law-book of Manu begins with an account of the creation of the world, and exhibits a strange confusion of religion, morality, and philosophy with law, civil and criminal. But some of its moral precepts are worthy of Christianity itself. Even love to enemies was enjoined: "Not only forgive, but even do good to him who is planning thy ruin, just as the sandal tree in its fall makes

* See Maine's *Early Law and Custom*, ch. ii, on "Religion and Law."

fragrant the axe that is felling it." The book of Manu occupies an intermediate place between, on the one hand, purely civil codes of law and the ethical teachings of philosophers, and on the other, those systems of religious ethics which are contained in the sacred books of the world. The question of the origin of these bodies of sacred law is one which we cannot now discuss; it must suffice to remind you that many nations, including the Jews, Egyptians, Persians and Hindoos, trace their laws to a traditional great lawgiver, to whom the laws were believed to have been divinely communicated.*

III. *Religious Ethical Systems.*

From systems of Sacred Law we pass naturally to the consideration of the ethical systems embodied in what are usually known as the great *religions* of the world. No word has undergone more changes of meaning, or is more difficult to define, than this famous word Religion.† Among ourselves, in the Middle Ages, it meant simply a monastic order,‡ and when we now speak of "the great religions," we include several which could not come under that head unless we adopt a very wide meaning indeed for the word Religion. Its primary sense, if we adopt the derivation from *religare*, is that of *binding*, and this connects it naturally with *Law*, a word also possessing the primary signification of binding or restraining. Law and Religion are far more closely connected than is generally recognised, and they constitute the two greatest binding or restraining influences on mankind. In the case of the philosophical systems we have noticed, the

* See the author's paper on *The Influence of Literature on the Growth of Religion and Law.*

† For a discussion of the various meanings of *religion*, and the etymology of the word, see M. Müller's *Hibbert Lectures*, 1878, pp. 10 *et seq.*

‡ Trench, *Select Glossary*, p. 208.

closer the system drew its adherents together into a kind of brotherhood or sect, the more it became of a distinctly *religious* character.

Regarded from an ethical point of view, the great religions appear to fall into three divisions. First, we find systems of theological belief almost or entirely devoid of moral teaching. Secondly, there are certain so-called religions which are in reality mere systems of morals, with little or no theological belief. And, thirdly, we find religions like our own Christianity, consisting of a mixed system of belief and practice, or in other words, of a moral system enforced by religious belief;—in technical language, by the religious sanction.

(1.) Theological Systems containing few or no Moral Rules.

It is curious that this group should include the primitive beliefs of savage nations, and the religion of the Greeks, the most cultured nation of antiquity.

(*a.*) *Savage Religions.* It is needful to remember that morality is not connected with religion in rudimentary civilisation. "Savage animism," Mr. Tylor tells us, "is almost devoid of that ethical element which to the educated mind is the very mainspring of practical religion." Not that morality is wanting in the life of lower races, but their ethical laws "stand on their own ground of tradition and public opinion, comparatively independent of the animistic belief and rites which exist beside them." *

(*b.*) *The Religion of Ancient Greece.* Very noteworthy it is that the Greek nation, whose philosophical ethical systems have been the admiration of all succeeding centuries, should have possessed a religion almost or entirely devoid of ethical teaching, one which had "no proper idea of God; no

* *Primitive Culture*, vol. ii, 360; and see vol. i, p. 427.

well-grounded hope of immortality; no proper sense of sin; and made no provision for the problems of life and the world."

(*c.*) *Brahmanism.* We have already mentioned the characteristics of the later Brahman schools of philosophy. Brahmanism itself supplanted the child-like simple devotion and prayers and hymns of the Vedic period, and introduced an elaborate system of caste and sacrificial ritual, almost devoid of ethical teaching. Indeed, as Principal Caird has well remarked,* its tendency was rather to dissociate morality from religion; and its social results were disastrous, for it had a pernicious effect in upholding and preserving the iron bondage of caste distinctions.

(*d.*) *Other Non-ethical Religions.* Little is known of the ethical teaching of the early Babylonian religion, but some of the hymns shew a very strong sense of sin, and great contrition on the part of the worshipper. The ancient religions of Mexico and Peru seem to have had but little of the moral element in them. All that the most recent authority on the subject can tell us is that the Mexicans were "taught to consider a decent and virtuous life as required by the gods." †

(2.) MORAL SYSTEMS WITH LITTLE OR NO THEOLOGY.

We next come to a group of three so-called "religions" in which the moral teaching is not enforced by any religious sanction, and there is little or no acknowledgment of a divine Being or Beings. These are Confucianism, Taouism, and Buddhism.

I. *Confucianism* is remarkable for the absence of spiritualism. It is really an elaborate politico-ethical system, of which the avowed ultimate aim is the right government of

* *Faiths of the World*, p. 51.
† Reville, *Hibbert Lectures*, 1884, p. 104.

the state, and the tranquillity and happiness of the empire. To this end, Confucianism lays down an ideal to which all may attain in the shape of the so-called Superior Man. Great stress is laid on sincerity in thoughts and words, on courage, truth, and honesty, but there is little inculcation of the active forms of virtue. Confucianism looks inward, and not outward. The highest virtue of all is filial piety. But the whole system is one of a cold, unemotional morality. The whole of a Chinaman's life, down to the smallest and most trivial details, is regulated according to precepts laid down in the ancient *Le-ke*, or Book of Ceremonial; and Confucianism may well be described as a system of frozen morality.

II. *Taouism.* This, like the last, is a politico-ethical system; and its Founder placed before men an ideal man—the Sage. Great stress was laid on *inward* rightness, especially modesty and self-denial, but little was said as to truth and honesty; and this system also is wanting in the inculcation of benevolence. Confucius taught the principle of reciprocity—evil for evil, and good for good; but Lao-Tsze proclaimed the golden rule of Christianity—"Recompense evil with good." It is curious to find this ancient Chinese philosopher moralizing on the strength of the weak things of this world.

III. *Buddhism* is the third and highest of this group of non-theological religions. Its chief features are self-conquest and universal charity. Let me quote from three well-known Buddhist works. The celebrated Buddhist "Beatitudes" enumerate among the "greatest blessings"—To bestow alms and live righteously; to abhor and cease from sin; not to be weary in well-doing; to be reverent and lowly, contented and grateful, long-suffering and meek, self-restrained and pure. The great problem of life is how to escape sorrow, and every fetter that binds us to life (Beat. 241). And the "Way"

is the celebrated *middle-path*—moderation, neither asceticism nor self-indulgence (Beat. 211). Very beautiful and Christ-like are many of the precepts. In the "Treasure Chapter" we read that

> What men call treasure, when laid up, profiteth nothing, and is easily lost;
> The (real) treasure is that laid up by man or woman
> Through charity and piety, temperance and self-control.
>
> . . . .
>
> The treasure thus hid is secure, and passes not away;
> Though he leave the fleeting riches of this world, this a man takes with him—
> A treasure that no wrong of others, and no thief can steal.

And in the *Dhammapada*, or "Scripture Verses":—

> 5. Never in this world does hatred cease by hatred;
> Hatred ceases by love.
> 50. Not where others fail, or do, or leave undone,
> The wise should notice what himself has done or left undone.
> 121. Let no man think lightly of sin, saying in his heart, "It cannot overtake me."
> 159. Let a man make himself what he preaches to others.
> 223. Let a man overcome anger by kindness, evil by good;
> Let him conquer the stingy by a gift, the liar by truth.
> 224. Let him speak the truth; let him not yield to anger;
> Let him give when asked, even from the little he has.*

By its inculcation of a spirit of universal brotherhood and charity, and, above all, by the *living example of a pure and holy life* in the person of the Founder, Buddhism ranks ethically far above such a system as that of Confucius, with its cold abstract ideal of a "superior man." We may, indeed, rank it next to Christianity. Gautama gained the intense personal love and affection of his followers, who treasured up his sayings and fables in their hearts. Much of

* Rhys Davids' *Buddhism*, pp. 127–131.

his moral teaching was conveyed by little stories or fables, corresponding very much to the parables of Christianity. The Jataka book, containing these fables, is the favourite reading-book at the moonlight services in Ceylon. Under the palm-trees a platform is put up, roofed, but open at the sides, and ornamented with light cloths and flowers, and round it the simple peasantry, dressed in their best and brightest, sit in the moonlight on the ground, listening through the night with unaffected delight to the sacred words read by the monks. There is at these festivals "a genuine feeling of humankindness, in harmony alike with the teachings of Gautama, and with the gentle beauty of these moonlight scenes."*

(3.) Systems of Mixed Morality and Theology.

The third and highest division of the religions of the world comprises those in which the ethical teaching is enforced by a true theological "sanction." In this group we find first, some unwritten religions, such as those of Rome and Egypt. Secondly, among written religions, three that are of a markedly legal character, viz., Zoroastrianism, Mahometanism and Judaism. Lastly, this group includes our own Christianity.

1. *Rome.* The religion of Rome was pre-eminently a domestic religion, a religion of the hearth and of the family. Let us not think lightly of it on this account, for in teaching the sacredness of family relations and domestic ties, it laid the foundations of such purity in home and public life as enabled the Romans to become the masters of the world. Domestic piety was the root of all Roman institutions; and a very noble foundation it was. With the causes of the grievous falling away under the later empire, we are not now concerned.

* Rhys Davids' *Buddhism*, pp. 57, 58.

2. *Scandinavia.* The ancient Teutons and Scandinavians worshipped *power;* their religion was one of *war*, but, at the same time, it was a worship of beneficent powers, from Odin the Supreme, and Thor, the poor man's best friend, down to the goddess Ran, the protector of poor drowned sailors. The "High Song of Odin" inculcates many noble principles—courage, faith, truthfulness, temperance, independence, and love of liberty.

3. *Ancient Egypt.* For an account of the interesting religion of Egypt, I cannot do better than refer you to Renouf's charming Lectures. "We cannot," he says, "resist the conviction that the recognised Egyptian code of morality was a very noble and refined one. None of the Christian virtues are forgotten—piety, charity, gentleness, self-command in word and action, chastity, the protection of the weak, benevolence towards the humble, deference to superiors, and respect for property in its minutest details." Great stress was laid on truthfulness and benevolence:—

> I have not altered a story in the telling of it.
>
> Doing that which is right, and hating that which is wrong, I was bread to the hungry, water to the thirsty, clothes to the naked, a refuge to him that was in want; that which I did to him, the great God hath done to me.*

We next come to three religions which form a group closely related to one another in several respects. They are all essentially systems of *Sacred Law*, and consequently we find in each an intense reverence and veneration for the written precepts of a great lawgiver. In other words, these three faiths exhibit more strikingly than any others the legal character which marks many early religions.

(1.) *Mahometanism.* This is the poorest of the three, from an ethical point of view. Mahometanism is a *polity*

* *Hibbert Lectures*, 1879, pp. 72, 74.

rather than a *faith;* and formalism is so strong an element in it that religion and morality seem almost entirely separated. Perhaps the highest point to which Mahomet attained is found in the second *sura* of the Koran:

> It is not righteousness that you turn your faces towards the east or the west, but righteousness is in him who believeth in God and the last day, and the angels and the Scripture and the prophets, and who giveth wealth for the love of God to his kinsfolk and to orphans, and the needy and the wayfarer, and them that ask, and for the freeing of slaves, and who is instant in prayer and giveth the alms; and those who fulfil their covenant when they covenant, and the patient in adversity and affliction, and in time of violence; these are they who are true, and these are they who fear God.*

The leading feature of Mahometanism is its intense insistance on the rigid performance of the five points of its "whole duty of man"—recital of its creed, prayer, fasting, almsgiving, and the pilgrimage. There is little or none of the "beauty of holiness" in this religion.

(2.) *Zoroastrianism.* This ancient faith is higher in moral elevation and endeavour than either Vedism or Mahometanism. It is a very practical religion. The leading object is to make men lead active and good lives; and it sums up its teaching in six words, "Good thoughts, good words, good deeds." Truthfulness, and faithfulness to promises, are strictly enjoined. Unlike the contemplative faiths of the far East, it urges to industry, and the importance of agriculture is strongly insisted on. But there is no idea of self-denial or self-sacrifice, either in Mahometanism or Zoroastrianism.

(3.) *Judaism.* Early Judaism was almost entirely deficient in the higher virtues, and in the sense of sin; it was essentially legal and ceremonial. Only in the later times of the Prophets and Psalmists does the growth of morality

* Lane Poole, *The Speeches of Mahomet*, p. 133.

shew itself in the more spiritual teaching of Isaiah and the Psalms. There is, perhaps, no more striking instance of the effect of a rise in morality upon a national religion.

A superstitious reverence for the written letter is exceedingly marked in the last three religions. In Zoroastrianism, the sacred books and holy formulæ are worshipped as divine; and even certain prayers themselves are prayed to in the Avesta. Prayer is regarded as a kind of spell or incantation. In Judaism, the curious Masoretic system represents the extreme influence of the written letter; and to this day devout Jews never pronounce the name of Jehovah in reading their sacred books, but substitute some other word, such as Adonai.

These three faiths are remarkable for the absence of the conception which has produced the highest types of morality, that of an Ideal Life, whether an abstract one or a spotless and blameless Example. And we do not find in them that injunction of kindness to all living creatures which so beautifully characterises the religions of India and China.

I would strongly draw your attention to the *legal* character of Judaism, Mahometanism, and Zoroastrianism, because it not only illustrates a very important phase in moral history, but forms the proper point from which to enter on the consideration of the ethical aspect of our own Christianity.

Far too little account has been taken of the legal character of early morality. I do not say that law comes before morals: a moral constitution of society is doubtless prior, both in conception and time, to a legal one. But it is highly probable that morality could never come to maturity were it not for the strength and permanence given to it in its infancy by law and government. Law, as embodied in written precepts, is the nurse and support of early national morality; and the Jewish religion is a very striking example

of a society bound together by a code of sacred laws. The idea of retribution in a *future* life does not appear till much later in the Jewish history, and future retribution evinces a higher but still a legal conception of morality, namely, that of rewards and punishments. This conception it must be remembered, though it belongs to Christianity, and has thus exercised an enormous influence over Christian Europe, was not strongly insisted on in the early days of the faith.

It is characteristic of morality that the higher it is the less it can be reduced to a system of rules. The greatest ethical teachers of mankind have seen this, and have left little or nothing of their own in writing. The moment morality freezes into written or legal rules it becomes rigid, and loses its vital power of growth and expansion.

Christianity. The glory of Christianity, as of Buddhism, is that its ethics are based on the imitation, not of an abstract ideal, such as the Greek "wise man" or Confucian "superior man," but of a living Example of blameless life in the person of the Founder. In both religions the deepest love and reverence is felt for a Master and Teacher who looked with infinite tenderness and compassion upon the sorrows of mankind, and actively strove to alleviate them.

In what then consists the ethical superiority of Christianity to all other moral systems? The answer is—Christianity touches the very mainspring of morals in looking to the *motive* rather than to the outward *act*. While rightness of heart consists, in all Pagan systems, of knowledge or wisdom, Christian rightness of heart consists of faith and love; the latter prompting to active beneficence and charity such as are inculcated by no other religion.

As Christianity respects the motive more than the act, the spirit more than the letter, its ethical teachings cannot be gathered together into a written code and so secured from change for centuries. It is a fearful thing for any nation

when the law, and still more the morality, of a certain stage in the national progress is crystallised into a sacred written system and thus rendered unalterable. Yet this is what has happened to the greater portion of mankind, and is the chief cause of their non-progressiveness. It causes them to look backwards and not forwards for their ideals, and this means a living death, morally and intellectually. Let us take the three most conspicuous instances of petrified morality.

The Chinese believe that all wisdom and knowledge is contained in their sacred books. Their morality is a cold ceremonial system of duty, laid down centuries before the Christian era, and, as we have said, the minutest acts of a Chinaman's life are in accordance with the ancient *Le-ke*, or Book of Rites, attributed to the 12th century B.C. The Hindu believes that he lives under an unalterable *Dharma*, or law, consisting of the legal, religious and moral systems laid down in his ancient sacred books. The Mohammedan is bound by a vast system of sacred (and therefore) unalterable law, social and moral; the Koran having, as has been well said, frozen Mohammedan thought.

How is it then that Christianity, though founded more than eighteen centuries ago, is progressive?

It is because it marks an advance beyond the legal stage of moral progress; we are not under the Law, but under Christ. Christianity is the only religion which cheerfully recognises and admits the fact of intellectual and moral progress—it is the only progressive religion.

A brief reference should be made to the ethical aspect of Asceticism, which has had so profound an influence on social and moral progress. It seems to me that Asceticism is not so much a peculiar kind of morality as a substitute for all forms of it. It supposes the absence of all those social relations on the right and healthy condition of which morality

depends. It is a renunciation of the world and all its institutions. And it is remarkable that few if any of the great religions were ascetic in their origin. None of the great teachers—Buddha, Mahomet, Moses, Confucius, Zoroaster, or Christ—advocated asceticism. It appears to engraft itself on religious and philosophical systems at a certain stage of their history, and to be a symptom of decay.

The mention of religious decay introduces an important point to which I wish, in conclusion, to draw your attention. Though it is doubtless true, as Max Müller tells us, that every religion is purest in its beginnings and can never continue to be what it was in the lifetime of its founder and first apostles, it is no less true that this decay of the written faith is compensated for by that wonderful silent growth of morality which at all times makes men better than their laws and their religious belief for the time being. This progressive morality periodically produces mighty reforms in ancient legal and religious systems, gradually substituting living morality for dead morality, the spirit for the letter. All human laws and ordinances are subject to corruption and decay, and need constant reform and correction by the sure though silent progress of that morality upon which they must ever be founded. There is grandeur in the conception of this constant reformation of ancient written religious and legal systems through the influence of Progressive Morality. It shews us that, among the progressive races of mankind, morality is indeed a living influence, leading us from the tyranny of the letter to the freedom of the spirit, and from a bondage to ancient systems to that which is far above all written rules—the loving and reverent imitation of a Perfect Life.

TECHNICAL EDUCATION IN ENGLAND: ITS PRESENT CONDITION AND PROSPECTS AS PRESENTED IN THE REPORTS OF THE ROYAL COMMISSIONERS.

By F. W. EDWARDS.

In the paper which I had the privilege of reading before this society in the earlier part of this session, an epitome was presented of the general condition of technical education on the continent, derived from the *Report of the Royal Commission* recently issued. I now proceed to draw upon the same authority for a similar account of technical education in England, and shall conclude with a consideration of the conclusions and recommendations of the Commissioners upon the whole subject.

Our modern system of industry was inaugurated early in the present century, when the remarkable inventions of Watt, Arkwright, Compton, Stephenson, and others gradually superseded the older and ruder appliances for spinning and weaving, and gave rise to the erection of huge mills and manufactories, wherein the powers of steam could have full scope, and the thousands of hands required for the work could have convenient accommodation. Thenceforward England had the exclusive possession, as well as all the advantages, of her improved machinery. So jealous was she of her unique position that, down to 1825, it was a penal offence to engage our artizans for employment abroad, and even until the reign of her present majesty the export of spinning machinery was prohibited. But about thirty years ago, signs were beginning to present themselves of the decay of

this monopoly, and of the rise of a growing competition abroad. Continental nations had been quietly erecting factories and mechanical workshops similar to our own; they had employed our skill and labour to construct their railways; and British commercial supremacy was further challenged by the introduction of those elaborate schemes of technical instruction which were the theme of my former paper. The consequence was that, within a very brief space, our high state of commercial prosperity began to decline. The outlook about twenty years ago was thus described by a writer of experience* :—

> The time is approaching when, through the rapidly increasing acquisition of the best machinery by countries already highly advanced in design, the struggle for supremacy in manufacturing will have to be fought out on other grounds than mechanical power or novelty of material; and should narrow jealousies and false notions of economy operate against the skill of our artizans being cultivated in at least the same proportion as other countries amass mechanical aids, we may have to realize in sorrow the narrow views and improvidence of our prosperous season.

These gloomy forebodings were not immediately realized, but their accuracy of view has since been justified by the frequency of long continued depressions, during which some branches of our industry have entirely gone, and others have been left behind in a languishing condition. But Englishmen are not accustomed to see a danger and quietly ignore it, and measures were soon adopted for the recovery of our waning reputation. The necessity for a more thorough cultivation of the skill of our middle and lower classes was first felt, and this led to the re-establishment of the old school of design in a new home, at South Kensington, in 1856, since known as the National Art Training School. With this was soon after incorporated the Normal School of

* Paper on *Industry and Art*, by Alfred Harris, Esq.

Science and the Royal School of Mines. With the exception of the universities, these training schools were the first public institutions that provided a comprehensive course of instruction in science and art, and their value was greatly enhanced by the subsequent establishment of yearly examinations, the granting of certificates, and the inauguration of exhibitions, scholarships, and free studentships. Considerable impetus was further given to this movement by the great demand for scientific instruction of a technical character after the Great Exhibition of 1851, and the Education Department rendered material support in the shape of money grants to the classes which were initiated under their control throughout the country.

The institution of industrial schools and reformatories, wherein ordinary elementary instruction was made to alternate with training in handicraft occupations, was another means of promoting the movement which had now set in.

In 1867, the late Professor Stanley Jevons, of Owens College, Manchester, propounded a scheme of technical instruction, and submitted it to the consideration of the various trade organizations of the country. His views were adopted by the Amalgamated Society of Carpenters and Joiners of Great Britain, and a strong effort was made to inaugurate classes in some of the large towns for the instruction of apprentices in the building trades. The following year, the Council of Owens College took up the subject, and sent Professors Greenwood and Roscoe to visit the principal technical schools of Germany and Switzerland, and ascertain how far the higher education therein imparted could be advantageously adapted to the manufacturing industries of the great cotton district. The result of their mission was the erection of the new college buildings in 1870, in which provision was made for the teaching of chemistry and

engineering and other allied arts. The pioneers who deserve honourable recognition in this special movement were Sir Henry Roscoe and Sir Joseph Whitworth, the latter of whom, by his almost boundless liberality in founding scholarships and exhibitions, has rendered incalculable service in the advancement of mechanical science.

The whole country was now alive to the necessity of the times, which were fully ripe for the introduction of a national system of education, available to every class of the community. And thus arose the memorable Elementary Education Act of 1870, the rapid formation of innumerable School Boards, and the multiplication of handsome and commodious schools throughout the country. It was soon perceived, however, that ordinary elementary education alone was insufficient to enable our workmen to grapple with their foreign rivals, and the *Report of the Royal Commission* published in 1872, drew public attention to the need of a more strictly scientific teaching for our artizan classes. To bring this to actual practice, the Society of Arts in London established, in 1874, a series of examinations in technological subjects, and the granting of certificates of proficiency therein. These examinations were afterwards taken over by the City and Guilds of London Institute, and will be referred to later on.

Another attempt in the same direction was the foundation of Mason College in Birmingham, which was opened in 1880, at a cost of £200,000, for the purpose of providing, as the first deed states, "a thoroughly systematic instruction adapted to the practical, mechanical, and artistic requirements of the manufacturing and industrial pursuits of the Midland district, to the exclusion of mere literary education." This laudable object has unfortunately not been carried out, and the college thus intended as a technical school has become a university college of the ordinary type for the attainment of degrees.

Soon after this, the Worshipful Company of Clothworkers, of London, began to give direct pecuniary aid to technical instruction, more particularly in its relation to the textile manufactures of Yorkshire. Their support was first given to the erection and endowment of a new wing to the Leeds College, and the establishment there of valuable scholarships, open to the surrounding district. They next extended their generosity in the formation of technical schools at Bradford and Huddersfield, the two most important centres of the woollen trade. In both of these towns, large and handsomely appointed buildings have been erected, and complete instruction is offered in the arts of dyeing and weaving, as well as in other industrial subjects. The Bradford Technical College, which was opened in 1882, is probably the most extensive and efficiently equipped institution of its class in this country up to the present time, and is well worthy of inspection. More than eight hundred students attend its classes. It has separate departments, under experienced professors and teachers, for pure art, weaving, designing, chemistry and dyeing, mechanical engineering, and the sciences connected with building and its allied trades. Elaborate and systematic instruction is offered in the nature and properties of the raw material, and the immediate application of design to woven fabrics. The whole routine in the manufacture of all textiles is clearly demonstrated. The students are carefully grounded in the principles of chemistry. They are taught to apply these in the laboratory, by analysis and experiment, in the investigation of the properties and uses of dyeing materials. The engineering and machine-making department is undoubtedly the best example of its kind yet established. The workshops are fitted up with almost every mechanical tool and appliance of note. It is impossible to overrate the eminently practical character of this noble institution, and its perfect adaptation

in every important respect for the furtherance and protection of Bradford's staple industries. About sixty boys are annually admitted by competition from the elementary schools, to receive two years' free instruction. In addition to art rooms and galleries, chemical and dyeing laboratories, weaving and designing rooms, and mechanical workshops, there is a large lecture-hall, a reading-room, and an extensive museum. In the latter may be seen many examples of textile work in every process of manufacture, from the raw product to the finished material. All nationalities are here represented in their numerous and varied forms of colour and design. The complete detail as regards the manufacture of cotton and wool may be studied with the most scientific accuracy, and the many phases of the processes are most interesting and attractive. It may be also mentioned that a movement has been started by the heads of this college to inaugurate a Society of Textile Colourists, for promoting the study of the theory of dyeing, so essential a part of the Bradford trade.

The Huddersfield Technical School was opened in 1883, and was a development of the old Mechanics' Institute, which itself had set the example, as far back as 1848, of establishing the first provincial School of Design in England. Considering that the town was the centre of the fancy woollen manufactures, it was felt that the appointment of a professional designer to instruct the operatives in the art of design, was essential to the continued prosperity of the district. And it is gratifying to learn, on the authority of the secretary, who has had a long and honourable connection with technical education in Huddersfield, that the school so formed has been the means of training numerous artizans who are now filling responsible positions as designers to the chief manufacturers of the neighbourhood.

The Manchester Technical School was opened in the

same year as that of Huddersfield, and like it was also an offshoot of the old Mechanics' Institute. Its classes are attended by about twelve hundred students, and it offers a series of valuable scholarships, exhibitions and studentships, tenable at various other educational institutions.

Sheffield does not at present possess a technical school, although active means are being taken to remedy the want. It is only fair to notice, however, that manual work has already been assimilated with the ordinary elementary instruction of their board schools, and has prepared the way for a much larger scheme.

It it hardly necessary, and it would be tedious, to refer to other minor Technical Schools, or to the numerous science and art classes that have sprung up in nearly every town and city during the last quarter of a century, and which have been supported more or less by grants from the central authority in London. Many of them have struggled bravely against adverse fortunes, and particularly against the difficulty of obtaining sufficiently qualified teachers for the low remuneration that was offered. Few institutions can render good service beyond their resources, and the science and art classes have been crippled by the low scale of their fees, the parsimoniousness of the Government grants, and the bareness of their subscription lists. Two examples to the contrary are mentioned in the report: the schools of Oldham and Keighley, the respective centres of the machine manufacture for the cotton and woollen trades. The success of these schools, however, is mainly due to the liberal support they have received from the manufacturers in their districts, and to some other features which are described by the Commissioners—features which have in reality been derived from the system of the continental schools.

At Keighley—

The deserving poor boy is admitted from the elementary school to

the trade school for two years' tuition free of cost; he may be retained in the trade school for two years after his exhibition expires, and has the opportunity of winning further exhibitions to South Kensington, where he receives the highest scientific instruction, under the most distinguished professors, at the Normal School of Science. These advantages are open to students in evening classes, and in a great number of instances have been fully enjoyed by them.

A weaving department is in operation, and an extension of the building is also contemplated, whereby workshops, a chemical laboratory, and a museum, will be added, to which the Clothworkers' Company have again offered substantial assistance.

The Oldham School of Science and Art, founded in 1865, owes its rise and progress to the munificence of the Platt family, at whose sole cost the first building was erected. Its success has since induced them to establish a larger institution, which is attended by 800 students. This is mainly an evening school, adapted for the instruction of all engaged in the various mechanical and textile works of the neighbourhood. The Commissioners express the opinion that "it may be regarded as an excellent sample of the kind of school which should exist in every industrial town in the kingdom, care of course being taken to arrange the instruction so as to be applicable to the several requirements of the districts in which they are situated."

Before leaving this part of my subject I must not be unmindful that this paper has been prepared for, and is being read before, a Liverpool audience, and that I must in courtesy at least make special mention of the Liverpool School of Science, established in 1861, in conjunction with the Free Library and Museum. The institution deserves honourable mention because it has now assumed a permanent form, has an active organisation, and is full of vitality. It has more than 900 students, a greater number

probably than any similar school, and it stands in the fortunate position of having earned the largest grant yet claimed for "payment on results." It endeavours to promote, not only a knowledge of science and art, but the application of both to various industries. To secure this object, the teachers employed are all practical men, whose previous training has been mainly in the direction of the special subject they teach. Thus, for mechanics and steam, the instructor has passed through the workshops and drawing office of well-known shipbuilders on the Mersey. In building and mechanical construction, the teacher has had practical experience with a leading firm of builders, and in one of the principal foundries of Liverpool. Carpentry and Joinery are taught by a foreman joiner in the employ of the Dock Board; while chemistry is represented by gentlemen practising as professional analysts. Owing to the lack of suitable accommodation at the Free Library, many of the classes are held in various parts of the city, with much inconvenience to all concerned. A large central building is urgently needed, so that the classes, and the official routine appertaining to them, could be conducted under one roof. Should the proposed Marine Exhibition, to be held next year, prove financially successful, the surplus might be usefully employed towards the erection of the structure which is so much required.* In the event of this being realised, sufficient accommodation might be provided, so that, if possible, the Liverpool Science and Art Classes—a rival, but friendly organisation, which is also exerting a good influence in the city—could be amalgamated with, and enjoy the use of the same central building.

Having now briefly described the most prominent features of technical education in the provinces, we may pass on to

* It is gratifying to observe that this suggestion has in spirit been adopted by the Committee of the proposed Exhibition.

observe what is being done in the metropolis. It may be stated at the outset, that nearly the whole of the technical instruction available to the artizan class in London has been provided by the City Livery Companies. It is impossible to give a clear account of the course of events in the metropolis without referring to the Report of the City Guilds' Commission issued last year, and pointing out the important bearing it will probably have upon the future progress of technical education.

It scarcely required a Royal Commission to tell us how far these City Guilds had departed from their original functions. Like the black silk stockings of Sir John Cutler, celebrated by Pope, which had been so often darned with worsted that little of the original fabric remained, they had to all appearance outlived their time. They have been subjected to many investigations, inquiries, and reports, but the remembrance of the services they had rendered in the growth of civic freedom, and the benefits they had conferred upon the trading community, has preserved them from extinction. The report now under review presents an admirable summary of their history, constitution, progress, and decay, and is in every respect deserving of careful study.

In addition to a trust income of £200,000 per annum, the City Guilds have corporate revenues of nearly £600,000.

The majority of the Commissioners consider that the state should at once interfere to prevent the alienation of this immense wealth, so as to secure its permanent application to useful purposes, and divert the trusts into beneficial channels, such as those of education generally, and scientific research. The revenues, they suggest, should be further devoted to the providing of libraries, picture galleries and museums, hospitals, baths, parks and open spaces; to the improvement of workmens' dwellings, and the benefit of their trade societies.

Pending the legislative action which may result from such drastic remedies, the Livery Companies with judicious forethought have anticipated some of these proposals, and have resolved to apportion a large share of their Corporate Revenue for the support of technical instruction. Sums varying from £200 to £400 have been granted to University College, to King's College, the Horological Institute, and the School of Art Wood Carving, in London, to Firth College, Sheffield, University College, Nottingham, and the Technical School, Manchester. They have helped to establish technical schools at Leicester, Nottingham, and Manchester. They have also assisted evening classes in many large manufacturing towns by means of small grants, and further subsidized other educational establishments where sound technical instruction is given. Their great work, however, has been the foundation of the City and Guilds of London Institute in 1883.

This new organisation was originated for the purpose of providing complete Technical instruction for all who are engaged in any industry in this country. As already shown, it gives aid to existing institutions that promote the common object. It encourages evening classes for foremen and workmen occupied during the day, and it aims at special scientific instruction for these in those processes by which they are earning their livelihood. It also strives to establish and maintain model technical schools in the metropolis, to serve as types of others which it hopes to stimulate every large town or district to erect by local effort. It has built, at a cost of £100,000, a large Central Institute at South Kensington, corresponding to the Polytechnic Schools of Germany and Switzerland, and to the École Centrale and École Polytechnique, of Paris.

This parent college desires to affiliate all other technical institutions that have been, or may be, established elsewhere.

It has been designed both as a normal school for the training of teachers, and as a university to preside over many kindred schools and classes in London and the provinces, directing their course of education, and, by a formal system of examination, offering suitable certificates to teachers as diplomas of proficiency.

If it is efficiently conducted, the City and Guilds of London Institute will probably become the chief authority for technical education in England. In this capacity it will render splendid service in the work of reviving, controlling, and improving industry, and allying it more closely than has hitherto been the case with science and art.

It is to be hoped that the founders of this new Central College at South Kensington will not stay their hand at the mere erection of a building which is replete with museums, lecture halls, mechanical, chemical, and scientific workshops, laboratories, and class rooms. The great wealth of the companies could not be better applied than by allowing it to permeate through the kingdom for the restoration of those trades from which it originally came.

It was said of old that "Socrates brought philosophy down from heaven to inhabit among men." The city companies seem disposed to follow his example by their endeavours to infuse the work of our artificers with the divine spirit; and the Central Institute, the Finsbury Technical School, and the Technical Art School at Kennington, are standing witnesses of their wisdom and enterprise in this respect.

The Finsbury Technical College was opened in 1883, at a cost of about £36,000. It is intended as a model trade school for the instruction of metropolitan artizans and others desirous of preparing for intermediate posts in industrial works. It consists of a day and evening school for Art and Applied Science, and has the following departments:—

1. Mechanical engineering.
2. Electrical engineering.
3. Industries involving applications of chemistry.
4. Building trades.
5. Applied art industries.

The chief trades of the district, such as cabinet making, carpentry and joinery, and various forms of engineering and metal working, are thoroughly taught. Within the college are chemical, physical, and electrical laboratories. There are also workshops suitably supplied with benches, lathes, and tools for instruction in the manipulation of both wood and iron, under the charge of practical mechanics. Upwards of seven hundred students attend its classes. The day department opens at 9.30 a.m. and closes at 5 p.m., there being an intermission of half-an-hour in the middle of the day. The students go through a course of practical science teaching in the various laboratories. They also learn free-hand and mechanical drawing, and one foreign language, and are compelled to spend at least three hours each week in the workshops.

The City and Guilds of London Technical Art School at Kennington also provides instruction for the artizan class, but more particularly for those engaged in any industry in which a knowledge of art is necessary. Day and evening classes are held for men and women, the subjects being drawing, modelling, and painting from life, wood engraving, china painting, enamelling, and design. The Livery Companies of London have thus endeavoured by the aid of both these institutions to supply efficient technical instruction, appropriate to every industry, and available at a nominal cost to the whole of the working classes of the metropolis.

The Polytechnic Young Mens' Christian Institute also offers instruction to apprentices and young artizans. Numerous classes are held in connection with the City and Guilds

of London Institute, in nearly every handicraft trade. It has 2,000 members, and £80,000 have been spent in the purchase, fitting up, and endowment of an institution that has had a very practical and successful existence.

I have now shewn the progress which technical education has made in England down to the present year, and it will have been observed that, until within the last three or four years, no real or systematic attempt was made to provide our artizans with the scientific knowledge essential to their successful competition with foreign workmen. In order that the new movement in this matter shall be continuous, the Commissioners draw certain conclusions as the basis of their recommendations for securing this desirable result. The most important of these I now propose to bring under your notice.

The Commissioners say that, although the Paris Exhibition of 1878 had led them to look for signs of great progress on the continent, they were not prepared for such a remarkable development of natural resources, nor such perfection in foreign industrial establishments as they found existing. They ascertained that a great deal of machinery of almost every kind is now made abroad, quite equal to our own, and adapted to its purposes with as much intelligence and skill. In many new chemical processes, such as the preparation of artificial colours from coal tar, they found that Germany unquestionably takes the lead; and that in the manufacture of soda, the economical production of coke, the recovery of tar and ammonia from coal, the ventilation of deep mines, and the scientific construction of roofs and bridges, we are only slowly following in the footsteps of our continental neighbours.

We are behind them again in the manufacture and design of the highest class of cotton printed fabrics, while the woollen cloths of Rheims and Roubaix are superior to

those of Bradford, especially in the dyeing; and the silk weaving and dyeing of Lyons are still pre-eminent. Intelligence, perseverance and thrift, combined with cheap labour, enable the Belgians to manufacture woollen yarns which find a ready market in Scotland; while the establishment of new textile industries, such as the ribbon trade of Basle, the velvets and silks of Crefeld, and the mixed fabrics of Chemnitz, denote a vigour and enterprise not excelled by anything of a similar nature in England. The success with which our neighbours abroad have thus been trained to compete with us is due to a more general cultivation, to the knowledge of modern languages, and economic geography, as well as to a greater carefulness and adaptability of character, all of them developed by the Technical High Schools which exist in nearly all the continental states, and which are maintained for the special benefit of the artizan.

The Commissioners further draw attention to the efficient technical instruction provided in the ordinary German universities, especially as regards chemistry; and reference is made to the fact that much of the prosperity in their large manufacturing works would not have been achieved but for the facilities which these universities offer for original scientific research. They also point out that in several prominent respects the education of continental artizans is more extended than with us. Elementary instruction is more generally diffused in Germany and Switzerland, the systematic teaching of drawing being the most striking feature. Free lectures and classes in every subject of interest in science, art, and literature, are conspicuous in every scheme of popular instruction. In such crowded cities as Brussels, Paris, and Lyons, the multitude throng the evening school, and receive gratuitous instruction in drawing, modelling, carving, and painting. Applied art is thus stimulated to a degree unknown on this side of the

channel. All the museums and celebrated collections of art are open to the public on Sundays, lectures and trade classes are also held in some instances on this day, and it is satisfactory to find that the benefits resulting have so far justified the experiment.

On the other hand, it is comforting to have the positive assurance of the Commissioners that, although the progress of other countries has been so great, nearly all the important machinery, as well as the processes employed in modern manufacturing, are due to the inventive power and skill of Englishmen. Our machinery is even still more extensively exported than formerly; the best machines constructed abroad are close imitations of our own, and new ideas, or developments of old ones, are quickly copied from the trade journals of this country, and adopted on the continent. In those textile fabrics in which other nations have hitherto excelled, we are rapidly gaining ground, while in the artistic manufacture of earthenware, glass ware, porcelain, and decorative furniture, our productions cannot be surpassed.

The Commissioners further agree in the conviction that, taken as a whole, our people still maintain their position at the head of the industrial world, and they believe this conviction is shared by continental manufacturers.

These conclusions suggest many others of equal interest, from which we might draw some valuable inferences. We must pass on, however, to enumerate the final recommendations, and learn what the Commissioners deem most desirable for the better training of those who are, or may be, engaged in the general trade pursuits of this kingdom.

These recommendations are arranged under the various heads of:—

Public elementary schools.

Classes under the science and art department, and grants by the department.

Training colleges for elementary teachers.
Secondary and technical instruction.
Public libraries and museums.
Special recommendations as to Ireland.

The great feature of the recommendations for public elementary schools is the suggestion that drawing should be incorporated with writing as a single elementary subject throughout all the standards. Drawing from models and casts, as well as modelling itself, should form a part of this scheme, which should be encouraged by special grants, not only for pecuniary rewards, but for the supply of the various objects required. Ability in the use of tools for the working of wood and iron should form a specific subject, the work when practicable to be done out of school hours. In rural schools, instruction in the principles and practice of agriculture should be made compulsory in the upper standards, and no children under fourteen should be allowed to work in factories and workshops as half-timers, unless they have passed the fifth standard.

These recommendations have already produced one result, the new Code for the present year specifying drawing as an ordinary class subject, on the same footing as geography and history. The advantages which have been derived from an extended teaching of this subject on the continent are fully shown in the report, and no one, I think, will be disposed to object to the capitation grants which will now be paid for its teaching in our elementary schools. Mr. John Heywood, of Manchester, has commenced to publish a series of excellent class-books adapted to the various standards, embodying an idea of Sir Henry Roscoe's, and shewing how easily and effectively writing and drawing may be incorporated as a single elementary subject.

Few, if any, will be inclined to dispute the advisability of introducing manual labour in our scheme of primary educa-

tion. Its results in France and other foreign countries afford the strongest inducement that can be given for its adoption in this country. Practical handicraft work is already taught in the board schools of Manchester and Sheffield. At Manchester, the boys are instructed in the use of tools, and the schools are provided with lathes and joiners' benches. At Sheffield, all the girls learn needle-work, and practice cookery, while those in the higher classes take chemistry. The boys are taught drawing, and it is made the basis of practical mechanical work in the shops which the school board have fitted up for the purpose.

Such examples might readily be followed by other large towns without waiting for legislative action. The hand would be trained in companionship with the brain, and manual work readily assimilated at an early stage with literary instruction, if the Education Department would encourage this new departure by grants on the same scale as the specific subjects of the Education Code.

The recommendations relating to the classes under the Science and Art Department are very large. The Commissioners would extend the present limited grants for building; school boards should be empowered to establish and maintain classes independent of the elementary schools, and they would make changes of the most practical character in all the classes. In their opinion, payment for results should increase with the advanced stages of the subject; special grants should be made for the actual execution of design; and the payment of fees by artizan students should not be required in all cases. Greater vigour should also be given to the work by a more efficient inspection; more attention should be paid to the adaptation of a design for the material in which it will have to be worked in the awarding of prizes; original examples likely to advance the industries of a district should be contributed to the local Museum.

The idea of authorising school boards to establish science and art classes for apprentices and artizans will, doubtless, meet with general approval. The large majority of our workmen are compelled to begin to earn their livelihood at an early age, and some provision should be made for giving them the opportunity of continuing their education during the years of apprenticeship. For the foreman who rises from the ranks, a further knowledge of the higher technique of his trade, and a ready skill in rule and compass drawing, seem most essential. The latter might with advantage be made compulsory in the education of all artizans. The Commissioners speak highly of the Natural Science teaching in operation at the board schools of Liverpool and Birmingham, and bear strong testimony to the sound character of the work. Systematic instruction in elementary science was introduced by the Liverpool School Board in 1877, and so far it has not marred the efficiency of the ordinary instruction. On the contrary, the percentage of passes has considerably improved. The proposal that science classes should assume a more practical character, and that grants should be increased as the stages of a subject advanced, will be regarded with satisfaction. The languishing condition of many provincial classes, and the small amount of real good that has come from them, are in the majority of instances due to the paltry grants they receive. It is not reasonable to expect that teachers of either experience or position will engage in such toilsome labour where the prospect of reward is so slight. The remedy must be to enlarge the grants, or allow municipal authorities to levy a small rate for the support of these classes. A combination of both would fit in with the existing scheme of elementary education. The issue of special grants for the actual carrying out of design is an important recommendation. Those who have visited the School of Design at South Kensington, will agree that,

as a central and national institution for this branch of art, it is not a credit to the country. Although it is presided over by professional gentlemen eminent in decorative art, its organization is of such a limited character that its influence must be quite local and unimportant. I had the privilege of visiting the school last year. The efforts of the students were then confined to working out on paper competitive designs for various industrial purposes. No attempt was apparently being made to put these designs into actual execution, and it is difficult therefore to understand how any practical knowledge could be gained as to their suitability to the material which was afterwards to give them a commercial value. Where no sympathy or motive is shewn, and where no industrial utility is evinced, it will be impossible to advocate or justify increased grants of public money for the teaching of art. It should be observed, however, that the Commissioners consider the time has arrived when a departure should be made from the principle by which these grants have hitherto been given, and that proficiency in applied art, as regards the material itself, should be directly encouraged. It is absurd that a design fully worked out in metal or pottery, or the actual modelling of a vase, should receive no higher grant than what is given for a mere design on paper. The report gives expression to the hope that the erection of Industrial Museums, which are strongly urged by the Commissioners, will tend to encourage more largely the growth of design and applied art in its relation to trade and manufacture.

Passing over the recommendations with regard to students in Training Colleges, which simply propose the sending of those who develop a special talent for further training in the Normal Schools of South Kensington, I will now proceed to the consideration of what the Commissioners advise on Secondary and Technical instruction, perhaps the

most important portion of all their recommendations, and that on which the future progress of technical education will mainly depend. Their proposals are three in number:—

1. The application of Ancient Endowments to Secondary and Technical instruction.

2. Provision out of the funds controlled by the Charity Commissioners for schools or departments wherein the teaching of Latin and Greek shall give place to the study of natural science, drawing, mathematics, and modern languages.

3. Permission for local authorities to establish and support, if they think fit, agricultural, secondary, and technical schools and colleges.

Much will depend upon the interpretation which the various public bodies concerned will put upon these suggestions, and the amount of responsibility they may be willing to assume in their adoption. The first and most onerous duty is clearly placed upon the shoulders of the ratepayers. This will entail either a general legislative Act for the United Kingdom, or a separate appeal from each municipality or district, for such powers as may be necessary to meet their special and individual wants. Considering that a sum of more than £3,000,000 sterling is now provided by the state for education, and that this amount is steadily increasing, it is hardly reasonable to suppose that the government will readily consent to add to this burden for the purpose of maintaining a scheme of technical instruction for the country generally. At present more than one-half of the aggregate cost of elementary education is paid out of imperial revenue, and almost the whole of the instruction provided for the working classes in art and science. Government may probably be induced to make grants for specific departments of manual work in elementary schools, and extend them in a larger measure to any technical colleges that have been, or may be, established.

Something of this kind has been done for years by the Local Government Board in the payment of industrial trainers in poor law and other industrial schools.

But after all the main support must be provided by local effort and generosity. As regards the diversion of ancient endowments to this purpose, it may be mentioned that by the transfer of the functions of the Endowed Schools' Commissioners to the Charity Commissioners, the latter body has a yearly income of £200,000 available for education. This sum of money would materially assist in founding such schools as the Commissioners believe to be desirable. They say that science and modern languages should be the chief subjects of instruction in secondary and endowed schools, even to the exclusion of classics. The endowments referred to are very unevenly distributed over the country, and the Commissioners point to this as a strong reason why local bodies should be allowed to originate and support secondary and technical schools. Time does not permit me to enlarge further upon this interesting point, but before leaving it, it may be stated that the Commissioners are of opinion that it is not desirable to introduce the continental system of technical instruction into England without considerable modification.

The recommendations of the Commissioners with respect to public libraries and museums are two in number. In the first place they propose that the Public Libraries Act shall be extended, so as to include institutions for technical instruction within its scope—a suggestion which will, no doubt, receive general approval. But the second one will not be so regarded. They propose that museums and galleries of art shall be open on Sundays. Under certain circumstances, perhaps, such a course would be found unobjectionable. Manchester, Birmingham, and Stoke-upon-Trent have adopted it, I believe, with very great advantage. We are

not, however, as a community, fully prepared for so great an innovation, and I will not for this reason discuss it.

The recommendations put forward by the Commissioners which do not depend upon the sanction of Parliament for their adoption are deserving of much consideration. Where a knowledge of art or science is beneficial to the due development of a trade, they deem it a necessity that technical instruction should be provided at the joint expense of employer and employed, either in schools attached to the works, or in classes wherever available. This instruction, they urge, should be made a condition of employment, and inducement should be held out for the more expert to proceed to the higher stages. On the same grounds they propose that the various agricultural societies should establish secondary schools or classes for the teaching of agriculture, and that the subscriptions given by the city of London and its various guilds should be devoted to the same general object. In the last case, the suggestion has already been put into practice, as I have endeavoured to show, both in London and the provinces. Many large employers of labour have also anticipated these particular recommendations by the establishment of private schools at their own cost, for the benefit of their own apprentices and artizans; such as those of Sir William Armstrong, of Elswick, Messrs. Mather and Platt, of Salford, and the London and North-Western Railway Co., at Crewe. The extension of such schools as these firms have founded, together with a general re-organization of the mechanics' institutes, would contribute largely towards that progress in artistic and scientific workmanship which is so imperative to our continued prosperity.

A better method in the arrangement of the subjects, especially as regards the grouping of those that are cognate and allied, and the founding of scholarships in greater

number and liberality, for the benefit of scholars desiring to pass from the elementary to the higher technical schools, are among the recommendations of the Commissioners in this direction.

The foundation of free and open scholarships of the Whitworth type, enabling students to develop special ability, and then continue their training in the technical colleges, would be of immense benefit. Such endowments, like their ancient brethren of the grammar schools and universities, can only be the outcome of private generosity, and when we reflect upon what has been done in this way by Sir Joseph Whitworth, Sir Wm. Armstrong, and the late Sir Josiah Mason, we cannot but hope for the assurance that others, like the Baxter family of Dundee, the late Charles Beyer of Manchester, and the late Mr. Harris of Preston, will eagerly follow in the footsteps of such noble benefactors, and leave behind them examples worthy of imitation and grateful remembrance.

The last suggestion of the Commissioners, that the central institution in London should be more adequately provided for by the City Livery Companies, is of the highest importance. Every effort should be made to secure its efficiency, and grants, donations, and scholarships should be liberally diffused and established, so that every artizan in the kingdom could feel that its benefits were open to him if he possessed the talents and the persevering industry necessary to all achievement. Who can calculate the immense influence which these central colleges, so richly endowed as to be practically free to the meanest artizan or apprentice in the land, would have upon our commercial and manufacturing progress? If the Livery Companies of London would devote a sufficient portion of their corporate trust funds to maintain only this one central institute in their own city, they would rouse the spirit of wise generosity in others, and

fulfil the most important of the functions for which they originally existed.

In concluding this review of technical education, I may add, that it is admitted on all sides that the old apprenticeship system has completely broken down. The obligation of the employer to teach his apprentices the mystery and craft of their calling has long since passed away with the disuse of indentures. Young workmen have thus lost the solid advantages which these documents conferred upon them, as well as those which the trade guilds secured to their predecessors. The action, moreover, of the modern Trades' Unions and Benefit Societies, by their persistent endeavours to reduce the rate of labour, both in quality and value, to a uniform level, has removed every encouragement to excel, and destroyed individual merit. The apprentice has, therefore, shewn no anxiety to learn more than what of necessity he could not fail to learn—the foreman has been at no pains to teach what he has not thought desirable. The workman has consequently grown up indifferent and careless, without any ambition, feeling quite satisfied that whether for good work or bad work his wages were all the same, and the union would stand by him. Should the recommendations of the Commissioners have the effect of stirring this fatal lethargy into healthy action, and firing English workmen with the same zeal that rouses their aspirations for national supremacy, their workmanship will be lifted by its artistic and scientific excellence into an equal supremacy, and British manufactures will again command the markets of the world.

NOTE.—*The Recommendations referred to in the preceding Paper are here reprinted from the Report of the Commissioners for the convenience of the reader.*

Having carefully considered what is desirable and practicable in regard to the general and technical instruction of the various classes

engaged in industrial pursuits in this country, we humbly offer the following recommendations, which require the intervention of the Legislature or of public departments:—

I. As to public elementary schools:

(*a.*) That rudimentary drawing be incorporated with writing as a single elementary subject, and that instruction in elementary drawing be continued throughout the standards. That the inspectors of the Education Department, Whitehall, be responsible for the instruction in drawing. That drawing from casts and models be required as part of the work, and that modelling be encouraged by grant.

(*b.*) That there be only two class subjects, instead of three, in the lower division of elementary schools, and that the object lessons for teaching elementary science shall include the subject of geography.

(*c.*) That, after reasonable notice, a school shall not be deemed to be provided with proper "apparatus of elementary instruction" under Article 115 of the Code, unless it have a proper supply of casts and models for drawing.

(*d.*) That proficiency in the use of tools for working in wood and iron be paid for as a "specific subject," arrangements being made for the work being done, so far as practicable, out of school hours. That special grants be made to schools in aid of collections of natural objects, casts, drawings, &c., suitable for school museums.

(*e.*) That in rural schools instruction in the principles and facts of agriculture, after suitable introductory object lessons, shall be made obligatory in the upper standards.

(*f.*) That the provision at present confined to Scotland, which prescribes that children under the age of 14 shall not be allowed to work as full-timers in factories and workshops unless they have passed in the Fifth Standard, be extended to England and Wales.

II. As to classes under the Science and Art Department, and grants by the Department:

(*a.*) That school boards have power to establish, conduct, and contribute to the maintenance of classes for young persons and adults (being artizans) under the Science and Art

Department. That in localities havingno school board the local authority have analogous powers

(*b.*) That the Science and Art Department shall arrange that the instruction in those science subjects which admit of it, shall be of a more practical character than it is at present, especially in the "honours" stage; that payment on results be increased in the advanced stages of all subjects, at least to the level of those now made for practical chemistry and metallurgy, and that greater encouragement be given to grouping.

(*c.*) That the examinations in agriculture be made to have a more practical bearing.

(*d.*) That metallurgy, if it be retained, be divided into groups, as (1) the precious metals, (2) those extracted from metalliferous mines, as copper, tin, lead, &c., (3) iron and steel. That mining be similarly divided into (1) coal and (2) metalliferous mining.

(*e.*) That the inspection of science classes by the Science and Art Department, with a view to ascertain the efficiency of the instruction, and of the apparatus and laboratories, be made more effective, with the assistance, where necessary, of local sub-inspectors.

(*f.*) That it shall not be a requirement of the Science and Art Department that payment of fees be demanded from artizans for instructions in the science and art classes.

(*g.*) That in the awards for industrial design more attention be paid by the Department, than is the case at present, to the applicability of the design to the material in which it is to be executed, and that special grants be made for the actual execution of designs under proper safeguards.

(*h.*) That the limits of the Building grants, under the Science and Art Department, to £500 each for schools of Art and of Science should be abolished, and the conditions attached to them be revised.

(*i.*) That, in addition to the loan of circulating collections and the grant of art reproductions at reduced cost, contributions be made to provincial industrial museums of original examples tending to advance the industries of the district in which such museums are situated.

III. Training Colleges for elementary teachers:

(*a.*) That the teaching of science and art in Training Colleges, and its inspection by the Science and Art Department, be made efficient, and that arrangements be made for giving to selected students in those Colleges greater facilities and inducements for the study of art and science in the National Art Training School and the Normal School of Science at South Kensington, the Royal College of Science for Ireland, and other Institutions of a similar class approved of by the Government.

IV. Secondary and technical instruction:

(*a.*) That steps be taken to accelerate the application of ancient endowments, under amended schemes, to secondary and technical instruction.

(*b.*) That provision be made by the Charity Commissioners for the establishment, in suitable localities, of schools, or departments of schools, in which the study of natural science, drawing, mathematics, and modern languages, shall take the place of Latin and Greek.

(*c.*) That local authorities be empowered, if they think fit, to establish, maintain, and contribute to the establishment and maintenance of secondary and technical (including agricultural) schools and colleges.

V. Public libraries and museums:

(*a.*) That ratepayers have power, by vote, to sanction the increase of the expenditure, under the Public Libraries Acts, beyond its present limit, and that the restriction of the Acts to localities having 5,000 inhabitants and upwards be repealed.

(*b.*) That museums of art and science and technological collections be opened to the public on Sundays.

VI. Special recommendations in regard to Ireland:

(*a.*) That steps be taken at the earliest possible moment for the gradual introduction of compulsory attendance at elementary schools in Ireland.

(*b.*) That payments be made by the National Board, under proper regulations, on the results of the teaching of home industries

to children, young persons, and adults; as well as in aid of the salaries of industrial teachers.

(*c*.) That systematic instruction be given to primary school teachers, qualifying them to teach the use of tools for working in wood and iron, in the primary schools.

(*d*.) That steps be taken by the Commissioners of National Education in Ireland for the provision of books calculated to assist the teachers of primary schools in giving graduated lessons in rudimentary science.

(*e*.) That grants-in-aid be sanctioned by the Treasury to approved agricultural schools, and to approved schools for instruction in local industries.

(*f*.) That practical evening science classes for artizans form part of the instruction in the Royal College of Science of Ireland, in Dublin.

(*g*.) That the Board of Intermediate Education take steps to ensure the provision of adequate means for the practical teaching of science in the schools under their direction.

In addition to the preceding recommendations which necessitate action on the part of the Legislature or of the public authorities, or of both, your Commissioners make the following recommendations, requiring no such action, by way of suggestions for the consideration of those in whose power it is to comply with them:—

I. That it be made a condition by employers of young persons, and by the trade organizations, in the case of industries for which an acquaintance with science or art is desirable, that such young persons requiring it, receive instruction therein either in schools attached to works or groups of works, or in such classes as may be available; the employers and trade organizations, in the latter case, contributing to the maintenance of such classes.

II. That the managers and promoters of science and technical classes should (*a*) so arrange the emoluments of teachers as to encourage them to retain their students for the advanced stages of subjects in which they have passed the elementary stage, and (*b*) that they should endeavour to group the teaching of cognate science subjects, as recommended by the Royal Commission on the Advancement of Science, and as

provided for by the regulations of the Science and Art Department.

III. That scholarships be more liberally founded, especially for pupils of higher elementary schools, enabling them to proceed to higher technical schools and colleges.

IV. That the great national agricultural societies give aid to the establishment in counties of secondary schools or classes for teaching agriculture.

V. That those responsible for the management of primary schools in Ireland, in the districts where farming is defective, attach small example farms to such schools wherever it is possible; and that boards of guardians employ the plots of land attached to workhouses for the agricultural instruction of the children therein.

VI. That the subscriptions given by the liberality of the City of London and of the different Guilds, to the City and Guilds Institute, be made adequate to the fulfilment of the work which that Institute has undertaken, including the equipment and maintenance of its Central Institution.

In closing our report, we think it right to recall the fact that the first impulse to an inquiry into the subject of technical instruction was given by the important letter of Dr., now Sir Lyon Playfair, K.C.B., of May 15, 1867, to the Chairman of the Schools' Inquiry Commission, in which he called attention to the great progress in engineering and manufactures abroad, shown at the Paris Exhibition of that year. In the course of our inquiry we have received much guidance from the letter on the subject by Mr. B. Samuelson, M.P., to the Vice-President of the Committee of Council on Education, dated November 16, 1867; from the report of the Select Committee of the House of Commons on Scientific Instruction, 1868; the Report of the Royal Commission on the same subject; the papers by Mr. H. M. Felkin on Chemnitz, by Messrs. McLaren and Beaumont, and various other publications.

We desire also to express our thanks to the public authorities, to the owners and managers of industrial works, and to the numerous other persons, both at home and abroad, to whom we had occasion to apply for information, for the frank and courteous manner in which it was given to us; and also to acknowledge the prompt and valuable

assistance which we received from the members of our Diplomatic and Consular services in the prosecution of our inquiry. All of which we humbly beg leave to submit for Your Majesty's gracious consideration.

(Signed) B. SAMUELSON.
H. E. ROSCOE.
PHILIP MAGNUS.
JOHN SLAGG.
SWIRE SMITH.
WM. WOODALL.

GILBERT R. REDGRAVE,
Secretary,
April 4, 1884.

NOTE ON THE ARMATURE OF THE BRANCHIAL SIPHON IN SOME SIMPLE ASCIDIANS.

By Professor HERDMAN, D.Sc.

In a recent number of the *Comptes-rendus*,* Professor H. de Lacaze-Duthiers drew attention to the circumstance that in certain Cynthiidæ the reflected portion of the test lining the branchial siphon is provided with minute projecting scales or processes. These are probably homologous with the long hair-like processes surrounding the apertures of *Cynthia papillata*, and of *Cynthia hispida*, Hrdn, and with the branched spines projecting from the outer surface of the test in *Boltenia legumen*, Lesson, *Cynthia formosa*,† Hrdn, and in *Cynthia echinata*, Linn.

In the cases now described by Lacaze-Duthiers, the processes are quite within the margin of the branchial aperture, and are of very small size. I observed this armed condition of the branchial siphon in some of the "Challenger" specimens about five years ago, and I figured,‡ in 1882, a microscopic specimen, showing it in the case of *Cynthia arenosa*, Hrdn. In this species the processes take the form of flattened triangular imbricating scales, with their free ends rather pointed. Lacaze-Duthiers' observations were made upon several species of *Cynthia*, so that the

* *Sur un élément microscopique pouvant guider dans la détermination des Cynthiadées, Comptes-rendus*, t. xcix, No. 25, Dec. 22nd, 1884.

† In this species, the spines are limited to the anterior half of the test, the rest of the surface being quite smooth. See "*Challenger*" *Reports*, vol. vi, part xvii, pl. xvi, fig. 1.

‡ Report upon the Tunicata collected during the voyage of H.M.S. "Challenger," part i, pl. xvi, fig. 9. "*Challenger*" *Reports*, vol. vi, part xvii.

structure, so far as is known, is limited to that genus. The processes differ considerably in shape and size in the different species in which they are present, and consequently are, probably, as Lacaze-Duthiers suggests, of value as diagnostic characters.

The question naturally arises whether it is possible to determine the use of this armature in the branchial siphon, and I think that very probably it has an important function in preventing Crustaceans or other injurious animals from entering the branchial sac. Copepoda are frequently found living as commensals in the branchial sacs of Simple Ascidians, and they probably enter when young, through the branchial siphon, along with the respiratory current of water. The tentacles at the base of the branchial siphon undoubtedly are of use in preventing injurious objects from passing into the branchial sac, but considerable spaces are usually left unguarded between the tentacles, especially at their bases, and it would probably be a great advantage to a species liable to be infested with Copepods to have the entire branchial siphon lined with projecting scales, arranged in such a manner as to arrest and retain any large object brought against them by the respiratory inhalent current of water.

In order to settle definitely whether this is really the function of the structures in question, it will be necessary to determine experimentally (1) whether the species provided with scales in the branchial siphon are less troubled by parasitic Crustacea than allied but unarmed species are, and (2) whether the scales are observed in the living animal to capture objects carried against them by the stream of water.

THE ARMORIAL BEARINGS OF THE ISLE OF MAN: THEIR ORIGIN, HISTORY, AND MEANING.

By JOHN NEWTON, M.R.C.S.E.

There is, I hope, no apology needed for bringing before you a subject drawn from the Isle of Man. No other place in Great Britain is so intimately associated with that island as Liverpool, and we have every reason to feel a special interest in all that regards it. The wild, rocky, seabeaten coasts, the picturesque mountains, glens and waterfalls, render it full of attractions to the casual tourist; for the chemist and mineralogist its richness in mines and minerals is enough: while, for the geologist, the immense variety of primitive rocks, granites, porphyries, greenstones, trap-rocks and basalts, ever and anon displayed in splendid sea-sections, continually lures him on. For the historian and the antiquary it has peculiar attractions. It appears with the first dawn of reliable history, so far as these islands are concerned, in the *Commentaries* of Julius Cæsar, where he says:—"In the mid sea between Britannia and Hibernia is an island called Mona." Colonised by the ancient British tribes, it remained long, like the isle of Anglesey, a chief seat of the Druids. Then it fell in succession under various yokes, the Scoto-Irish, the Welsh, the Anglo-Saxons, who in their turn were overcome by the Danes and Norwegians; and for near four hundred years the Vikings, those terrible pirates of the North, ruled with a troubled sway over Mona. At length, in the year 1266, the island was ceded to the king of Scotland, after which event its history ceases to have any bearing on the subject of this paper. To the antiquary a thousand points of interest present themselves. Commencing with the

prehistoric stone circles, barrows, and cromlechs of the primitive Celtic inhabitants, here are also to be found many remains of early British churches, founded in the fifth and following centuries by the followers of St. Patrick, whilst the Runic monuments, inscriptions, and crosses attest the long sway of the North men, their amalgamation with the natives, and their adoption of the Christian faith. Here, also, alone in Europe, is to be witnessed a perfect living example of the primitive folk-moot, or open-air assembly of the Notables, held yearly on the Tynwald Hill, when the laws of the island are publicly recited and proclaimed in Manx and in English—a wonderful survival, which our friend Mr. Gomme perfectly gloats over; for, lastly, the Manx have Home Rule, and yet are very loyal, as indeed they have good reason to be.

Those amongst you who know the island will be aware that I have scarcely touched on the innumerable points of interest that it presents; yet the average Liverpudlian knows nothing of these things, and his ideas of it are confined to its curious armorial bearings, to Manx herrings, and to Manx cats. As to the herrings, there is nothing to be said except in their praise, and as for the curious tailless cats, the native tradition is doubtless true, that they were introduced into the island in 1588 from the wreck of one of the Spanish Armada.

And now we come to the special subject of this paper, the armorial bearings of the island. In Liverpool, this strange, quaint device, the Three Legs of Man, meets one at every turn. Here it stands forth prominent at the street corner as a public house sign. We stroll down to the landing stage, and there it stares us in the face, painted and gilt, on the paddle boxes of the Manx steamers. What was the origin of a sign so remarkable?—what its hidden meaning?—for a significance it must have had, and a momentous one. We naturally turn to the volumes published by the Manx

Society for a solution of the enigma, and the fifth, published in 1860, is specially devoted to the subject. Here then, surely, our curiosity will be satisfied! It is entitled *Vestigia Insulæ Manniæ Antiquiora; or, a dissertation on the Armorial Bearings of the Isle of Man*, etc., by H. R. Oswald, Esq., F.A.S., &c. In this volume Mr. Oswald points out that *no armorial emblem in connection with the island is known to have existed before the time of the Norwegian domination;* the earliest traceable is that on the flag of the Norse Vikings, which was emblazoned with a ship in full sail, apt symbol of these sea-rovers. The ship has one mast, is clinker built, and resembles closely the Manx herring boats. Amongst the Cottonian MSS. there exist two charters of Harald, King of Man, with the dates 1245–6. Their seals bear the ship on one side, and a lion rampant on the other. But after the cession of the island to Alexander III of Scotland, twenty years later, this emblem of the Norwegian kings disappears entirely, and the three legs symbol takes its place, continuing to the present day. The form we usually see is thus described in heraldry:—Gules, three legs armed, conjoined in fesse at the upper part of the thighs, flexed in triangle, garnished and spurred, or. Motto: *Quocunque jeceris stabit*, that is "whichever way you throw it, it will stand." But this is a later modification, as the armour does not correspond to the thirteenth century, and in the earliest examples, which are of the time of Edward I of England, the legs are covered with *chain armour*, and are without spurs. There is also no motto, which, indeed, is evidently the invention of a later age. The earliest example of the arms of Man, *as now emblazoned*, given by Mr. Oswald, is not earlier than A.D. 1480, and this is without the motto. It appears then, almost certain, though we possess no literary document recording the fact, that to Alexander III of Scotland is due the introduction of the "tre cassyn" as the distinguishing arms

of the Isle of Man. But whence did he get it? *He* did not originate it, as Mr. Oswald points out; for every antiquary knows that this striking emblem was figured in various forms on Greek coins and Etruscan vases four or five hundred years before the Christian era. These, however, would be utterly unknown to a Scottish king in the thirteenth century, and neither Mr. Oswald nor any other writer, so far as I know, helps us to a reasonable solution of the difficulty. At first I thought it probable that Alexander might have derived it from the bracteates or gold medals, which he must have often seen worn on the breasts of Norwegian kings and chieftains. As amongst other nations, so it was the custom with the Northmen, to wear for amulets ornaments containing the sacred signs. With the Anglo-Saxons the signs were often formed of pieces of coloured glass or garnets set in gold. In the North they were formed of plain gold within a circle. The "suastika," as the figure is called in India (see fig. 8), was used as the emblem of their god Thor, the cross (fig. 9) as that of Odin, and the "triskele" (fig. 7) was the emblem of the sun-god Frey.

This latter is identical with the armorial bearing of the Isle of Man, as will be demonstrated further on. But, as will be seen, the emblem on these medals is invariably of a ruder, more primitive, and rudimentary type. It never appears on the Danish and Norwegian bracteates as three well developed male legs; and it is not likely that the Scotch of that age would at once make the transition to a more advanced and artistic form. We must, therefore, look elsewhere. Is there any nation that has employed this symbol—the three legs of man—on its coins, buildings, and banners, from before the Christian era down to our own day? There is, *and only one—Sicily*. Appearing first on the lovely Sicilian Greek coins about 300 B.C. it was so frequently repeated that the Romans gave the name of "triquĕtrum" or

three-cornered to the symbol itself, whilst the island of Sicily was called "Triquetra," the three-cornered or triangular island. Through all the reverses of the Sicilians, under the Romans, Goths, Saracens, and Normans, it was still used as part of their national arms, was embroidered on their banners, and carved on their buildings. Surely, then, from the Sicilians it must have been borrowed by the Scottish king. But how would the knowledge of it reach him? In several ways, perhaps. To the Crusaders we owe the introduction of Heraldry, and the era of the Crusades had not yet passed by. In the first enthusiastic longings to free the Holy Land from the Infidel even Scotland was moved. As William of Malmesbury writes:—"The most distant islands and savage countries were inspired with this ardent passion. The Welshman left his hunting, the Scotchman his fellowship with vermin, the Dane his drinking party, the Norwegian his raw fish." The Crusades had a most salutary influence in diffusing a knowledge of other countries, and Sicily, which shared so largely in the fortunes of the Crusaders, was the common resting-place on their way to the Holy Land. We must also not forget that Alexander's mother, a Norman-French princess, married for her second husband the son of the crusading king of Jerusalem. In this way then a Scottish king in the thirteenth century might have become acquainted with the arms of Sicily. But a far more potent influence than even the Crusades was the Norman conquests from the ninth to the fourteenth century, which placed the descendants of the Northmen on the thrones and in the high places of Church and State in nearly every country of Europe. Those hardy sea rovers who swarmed forth from the shores of Norway, Sweden, and Denmark, went forth conquering and to conquer. Their very religion was fitted for a nation of warriors, since a place in the Walhalla of Odin could only be won by those who had overcome and slain

in battle. The Swedish Norsemen directed their expeditions chiefly against the eastern coasts of the Baltic; they overran and subdued a large part of what is now called Russia; in the tenth century became dangerous enemies of the Byzantine empire, the coasts of which they reached by way of the Black Sea, and its capital, Constantinople, they attacked with upwards of one thousand ships, or boats, in the year 941. The Danish Norsemen ravaged and conquered nearly the whole of Germany and France, especially planting themselves in that part of the latter which was thenceforth called Normandy. These, the Normans of history, a most warlike, vigorous, and brilliant race, rapidly adopted the highly civilized form of life that prevailed in the Frankish kingdom, its religion, language, and manners, but inspired everything they borrowed with their own splendid vitality. In the year 1066 they finally overthrew the Anglo-Saxon monarchy, and William the Conqueror, the descendant of a Norse Viking, established the Norman rule in England. About the same time they obtained a footing in Southern Italy, and before the end of the eleventh century, Robert Guiscard and his brother Roger, both sons of a Norman knight, Tancred de Hauteville, were acknowledged by Pope Nicholas II as Lord of all lower Italy, and Count of Sicily. The latter and his descendants filled the Sicilian sees with Norman bishops, and many proofs might be given of the close intimacy that existed between the Normans of Sicily and those of England. Thus William II, or "the good" (died 1187), married Joan of England, sister of our Henry II, and had for his tutor, and afterwards prime minister, Walter-of-the-Mill, an Englishman, whom he appointed Archbishop of Palermo, and who built in 1169 part of the present cathedral. Frederick II (1197-1250), the most illustrious of the Norman kings of Sicily, married for his third wife Isabella, daughter of Henry III of England, by whom he had a son, Henry, who died

young. After his death, Manfred, a natural son of Frederick, who inherited many of the great qualities of his father, was appointed regent in 1254. Pope Innocent IV excommunicated him, and then claimed his kingdom as forfeited to the Holy See; but Manfred maintained his rights with an army and as he was supported by the Neapolitan and Sicilian people the Pope had no chance of succeeding unless he invited some foreign host into the heart of Italy. Alexander IV looked round among the princes of Europe for help, and at length, in the year 1255, he offered the crown of Sicily to Henry III of England for his younger son Edmund, and the priest-ridden king joyfully closed with the shameful proposal, agreeing to raise an army and march into Italy, accepting first a considerable advance of money from the Pope to commence the enterprise, and proposing to raise what more might be necessary by borrowing on his own and the Pope's security. Considerable preparations were made, and the king conferred upon his son beforehand the title of "King of Sicily." In the small circle of the English court this arrangement gave the highest satisfaction. The young Prince was paraded in public in the Italian costume, and with the state of royalty. He set his ring, though but a boy, to a deed by which the Bishop of Hereford, John d'Aigue-Blanche, received the crown of Sicily as his proxy (June 22, 1259). Banners, no doubt, with the three-legged symbol of Sicily were duly prepared, and the prince quartered the Sicilian arms with the royal arms of England.

Now mark the close connection of these facts with the subject of the present paper. Alexander III of Scotland, and his queen, Margaret, the youngest daughter of Henry III, visited the English Court at that very time. The treaty between the Pope and the King of England was signed April 9, 1255, and the visit of Alexander took place in

August, 1256. They were received with great pomp and state, and passed several months at the English court. Doubtless the young Scottish king would take the greatest interest in the preparations that were being made for the invasion of Sicily. Its future king was his wife's brother, and he would promise to raise a Scottish regiment to join the English army; whilst the queen and her ladies would busy themselves in preparing banners bearing the triquetra of Sicily. For several years (1255–59), the court continued occupied with this business, when Henry III, who was always in debt, finding that he could no longer make it an excuse for raising more money, allowed it to pass into the limbo of forgotten projects. A few years later occurred the invasion of Scotland by Haco, the Norwegian king, his defeat at the battle of Largs, the destruction of his fleet in a tempest, and his death; soon after which event the Isle of Man was ceded to Alexander, that is, in 1266. What more likely than that the king, when he struck the Norwegian flag, should replace it by one bearing the picturesque and striking device of Sicily, an island having so many points of resemblance with that of Man? He had probably a number of banners on hand of that island kingdom, so like his new acquisition, over which his wife's sister had ruled as queen, and her brother had been appointed as king. But the opportunity had been lost, and the flags were there. Surely, he did well to utilise them.*

And now we come to the most interesting question of all, the true origin and meaning of this symbol. Alexander, we have shewn, borrowed it from the Sicilians, who in their turn had employed it continuously for fifteen hundred years before

* Matthew Paris, *Chronicle*, 1254–60; H. Gally Knight, *The Normans in Sicily*; C. H. Pearson, *History of England during the Middle Ages*, vol. ii; E. W. Robertson, *Scotland under her Early Kings*, vol. ii; A. C. Hare, *Southern Italy and Sicily*.

his time. Doubtless he was perfectly ignorant of its primitive meaning, but it was appropriate, picturesque, and striking, and it served his turn.

From whence, then, did the Sicilians get it, and what was the idea it originally conveyed to them? On referring to Oswald's volume we meet with nothing but vague guesses, flung out at random. Here is one that he quotes from Nisbet: "It was a device of the Sicilians, the ancient possessors of the Isle of Man," an assertion which we know to be false. There is nothing easier than to solve a difficulty by manufacturing evidence. Another says, "The three legs conjoined were used by Sicily in allusion to its three headlands or promontories, whence its name, Trinăcria." But this also is set aside by the fact that the device is found on many early Greek coins of inland towns having no connection with Sicily. One antiquary suggests that Alexander adopted the three legs running, "because, as mentioned by Boethius, the Isle of Man had become the common resort of refugees, vagabonds, and runaways!" Another, "because the island looks towards three kingdoms—England, Scotland, and Ireland"; and, he adds, "from their former connection with it, legs have crept into the bearings of many private families in England! The Earl of Derby, for instance, quarters the Manx arms among his armorial bearings because the Stanleys were for two hundred years the lords of Man." Finally, Mr. Oswald tells us, as his own conclusion, that the three legs symbol "*is doubtless a chimera.*" But the "chimæra," as described in Greek legends and represented on their coins, bears no analogy whatever to the Isle of Man arms; it is a four-legged monster, having three heads—that of a lion, a man, and a goat (see fig. 35). So we are left, for all Mr. Oswald's researches, as far off as ever; and the most recent Guide-Books to the island, by Cumming and Jenkinson, add no more. Poor food this for those ardent, ever-

questioning souls whose whole life is an unsatisfied desire for more knowledge!

Now this device is called by the Manx, "tre cassyn," the three-footed; it was named by the Greeks "triskele," τρισκελη, the three legs; by the Romans, "triquetrum," the three-cornered, or triangular. Various forms of it are seen on Assyrian gems or signets, and on the coins of many Greek cities and colonies, as those of Aspendus, Lycia, Macedonia, and the Thracian Odomanti. These range from 700 to 400 years B.C. Then come the Sicilian coins, which have continued to repeat this curious symbol down to the beginning of the present century. It has been found also on early Greek and Etruscan vases, and on the curious gold medals or bracteates worn by the Northmen from the sixth to the thirteenth century. Unfortunately, these ancient peoples have left us no literary monument to tell us what they understood by it, and we are left to solve the enigma by the study of their figured monuments. These, at least, prove at the outset that it was once a religious symbol or hieroglyph of the deepest significance.

And now we find ourselves face to face with the tremendous question on which libraries of books have been and will yet be written: What were the ancient pagan worships—how did they originate—whence were they derived—what was their hidden meaning? The popular theory until of late, maintained, for instance, by Jacob Bryant, Faber, and the late Cardinal Wiseman, was that all these religions were corruptions of a primitive revelation, made to Adam or to Noah; but this idea has been so little supported by recent discoveries that it has gone out of fashion. Max Muller holds that man has always been a religious animal, and that his religions have been the result of his yearnings after the Infinite. Such an idea is too unpractical and intangible to help us in our present enquiry. Indeed, there is something

very carnal and business-like in most of these religions, the worshipper making as good a bargain as he could for mutual profit between his god and himself. Thus the prophet Habakkuk gives us a vivid picture of the Chaldean fishermen in his time worshipping their nets for good success. "Therefore," says he, "they sacrifice to their nets, and burn incense to their great drag-net, because by them their portion is fat and their food plenteous." How would Max Müller's theory aid us in grasping the reason for such an action?

Surely the fundamental idea that underlies all religions is the natural desire to propitiate, to gain over to our side every power that can help us or harm us, the mightier the better; and man looked abroad into the world ever in search of more powerful allies. It was bodily fear and hunger that made man religious—not a longing after the Infinite. And what object would claim his earliest worship—his deepest, most passionate homage? Surely the all-glorious Sun, by which he was warmed and fed; which daily awoke him from sleep and summoned him forth to labour. Was not the sunrise to him the first wonder, the first beginning of all reflection, of all poetry, of all religion? How shall we, "the latest seed of time," realise the awe with which the earliest dwellers on the earth saw that brilliant being slowly rising from out the darkness of the night, raising itself by its own might higher and higher, till it stood triumphant on the arch of heaven, and then descended and sank down in its fiery glory into the dark abyss of the heaving and hissing sea. As Max Müller tells us, "In the most sacred hymn of the *Veda*, the poet still wonders whether the sun will rise again; he asks how he can climb the vault of heaven—why he does not fall back—why there is *no* dust on *his* path? And when the rays of the morning rouse the worshipper from sleep, and call him back to new life; when he sees the sun, as he says, stretching out his

golden arms to bless the world and rescue it from the terrors of darkness, he exclaims, "Arise! our life, our spirit has come back; the darkness is gone, the light approaches." This, the morning prayer of the Brahmin, is the most sacred verse in the *Veda.* We might go through all the chief natural religions in succession, and it would be seen that they are more or less forms of sun-worship. Take that of ancient Egypt. Osiris, the supreme god, was the setting sun, the sun of the under-world; and the hope of every pious Egyptian was that in *that* world he might be united with Osiris, sail with him through the various regions of the heavens, seated in the solar boat, to rise with him as Horus, the rising sun, overcoming the darkness; the soul triumphing over death; the conqueror of Typhon. As to the religion of the Eastern nations, Dr. Oppert says, "All the Phœnician gods were forms of Baal, the sun, and all their goddesses Astarte," that is, the moon and earth goddess. The Teutonic nations spoke of the sun as "the eye of Wodin, and they also called the sun the face of their god" (Grimm, *Deutsche Mythologie*). For so prominent an object in the picture-gallery of the human mind, a sign or picture-symbol must have been invented at a very early period. The circle, as found in the Egyptian hieroglyphs, in the Chinese picture-writing, and in our common astronomical tables, would be the simplest possible sign. But something more was needed to indicate speed. One mode was to represent the disc as winged; thus was formed the Mihr, the most sacred emblem of divinity amongst the Egyptians, Babylonians, Assyrians, and Persians (see figs. 11 and 38). Another far simpler device, one of the commonest and most primitive of all, was formed by crossing the disc with four lines, and thus giving it the semblance of a wheel. Those early thinkers could not conceive the sun's disc as rapidly moving onward unless it revolved as well—trundled, in fact,

like a wheel. And thus the wheel, usually four-spoked, became a well-recognised solar emblem (see figs. 2, 3, 4, and 5). It appears on the reverse of many early Greek coins. The Northern sun-god held it as his symbol, and the worshippers of Mithra, the Persian sun-god, at their religious feasts partook of a consecrated bread in the form of circular cakes, with a cross on each, as his emblem. But the human mind in its restless activity was not satisfied with this; it endeavoured to give the idea of motion to the spokes of the wheel, and of *motion in one direction*, too. This was done ingeniously enough, by taking away part of the rim of the wheel, leaving sufficient to indicate its course; and thus was produced the "Suastika" of the Hindoos, the "Fylfot" of the Northern nations, perhaps the most characteristic and universally diffused of all the mystic emblems of sun-worship (see figs. 8, 15, and 16). It was inscribed, along with other well-known sun-emblems, on the circular amulets of terra-cotta found in great numbers by Dr. Schliemann amid the ruins of ancient Troy. It was borne by the warriors of Greece, Etruria and Rome, on their helmets and their shields, and was marked on their funeral urns. It is repeated on the hem of the garment of a grave-digger in the Roman catacombs, and appears constantly as the sign of Thor on the gold bracteates worn as sacred amulets on the breasts of the Northern Vikings (see figs. 18, 20, and 23).

Amongst the many remains of sun-worship which still linger in the Isle of Man, one is especially interesting in connection with the present subject. On the 5th July, that is, old Midsummer day, in each year is held the great assembly of the island, around the Tynwald Hill. On the summit sits the Lord of Man, his face to the east, and his sword held with the point upwards. The preceding evening, or Midsummer eve, fires are lighted on the hills, and the day is called in Manx, *Lhaa Boaldyn*, *i.e.*, "the day of

Baal's fire." A cart-wheel, tarred over and bound with straw, is taken to the top of a high hill, is then set on fire, and being started it trundles along into the valley beneath, a rude yet expressive emblem of the sun.

But a further development took place in the mind of these primitive worshippers. They conceived of the sun as a living being, resembling glorified humanity. The wheel was but the one visible wheel of his fiery chariot, drawn by four white horses. And thus the sun-god as a charioteer is a favourite device on the early Greek and Roman coins. See especially fig. 29, where a representation of the solar orb, rayed, forms the head of the charioteer. Sometimes a horse galloping, often winged to increase the idea of speed—the sun-horse—does duty for the whole (see figs. 22 and 32). The horse was counted specially sacred to the sun, because, as Herodotus explains, it is the swiftest of animals.*

In those old Pagan faiths which consecrated every pleasure, the chariot races became a joyous form of sun-worship. On the spinà of the Circus Maximus the statue of Apollo stood next to the obelisk, itself a sun-emblem, and thus struck the key-note of the allegorical allusion in the chariot-race. The course ran due east and west, or the sun's daily path. The twelve doors were the twelve signs of the Zodiac. The four factions, with their respective colours—green, red, blue, white—were emblematical of the four seasons; the four-yoked chariots were the sun, the two-yoked the moon, and the seven times round the course symbolised the seven days of the week, or the seven planets. On the top of the obelisk was a polished brass globe called the "pyropus," from which the sun's rays, reflected, seemed to bring the god

* The sacred horses and chariot of the sun preceded the armies of Cyrus and Xerxes (Herodotus i, 189; vii, 55), and when Josiah destroyed the idols of alienated Judah, "he took away the horses that the kings of Judah had given to the sun, at the entrance to the temple of Jehovah, and he burned the chariots of the sun with fire" (2 Kings xxiii, 11).

of day nearer to the race-course. "*Flammasque imitante Pyropo*" is the description of Ovid. And thus the sun presided over the races at Rome.

In the Book of Psalms the sun is compared to a swift runner. To the Hebrew poet the sun is "as a bridegroom coming out of his chamber, and rejoiceth as a strong man to run a race" (Ps. xix, 5). Here are two very distinct ideas of the all-glorious sun, conveyed in the two pictures. First he is the generator, the fertiliser, the source of new life; second, he moves through the heavens as a racer, a swift runner. The same ideas are embodied in a Greek coin of very early type (see fig. 24), in which the sun-god Apollo appears, holding in his right hand a budding branch, emblem of fertility and new life. He strides along—it would have been *infra dig.* to represent *him* as running—but the idea is conveyed vividly by a little nude figure, like his own, on his extended left arm, having four wings, two to the arms, two to the ankles, who is both running at full speed and flying at the same time. Now *it was a frequent practice to represent a complex symbol by some small portion of the same*, which, so long as it was characteristic, served to remind the devotee of the whole. Accordingly, the Greek warrior represented on an archaic vase (fig. 25) has placed on his circular shield, itself an emblem of the sun, the representation of *a single leg running*, and that was counted enough. The shield became thenceforth a sacred amulet, which claimed the special protection of the god.

But again, they desired to combine in one powerful symbol the two conceptions of the sun as a revolving wheel, and as a swift runner; and this was at length accomplished by the invention of the symbol we are discussing, the "triskele" of the Greeks, the "triquetrum" of the Romans, the "tre cassyn" of the Manx.

Some intermediate stages were, however, passed through

before the three legs symbol appears in the artistic form perpetuated for two thousand years on the Sicilian coins. Sometimes the "fylfot" or "suastika," which we have traced to the solar wheel, has its four spokes formed in curves, as is seen on the very ancient coins of Lycia (see fig. 15). On other Lycian coins the emblem has three curved arms only. This, the most primitive form of the "triskele," is found on some signets of Assyria and Babylonia, where it takes the place of the "Mihr," or winged sun. It reappears on the Danish medals or bracteates of the eighth even down to the twelfth century, plainly shewing that the Northern artists followed a very early tradition. But Greek art, which humanised everything, soon transformed the rude symbol. On some coins, probably as early as B.C. 500, a "triskele" appears formed by three naked human legs in the attitude of running, winged at the heels, with a "phallus" in the border between each. The wing and the phallus, be it remarked, are both sun-emblems (see figs. 27 and 30). Later on, the Sicilians usually represented the legs naked, and sometimes armed with greaves, like the Greek warriors of the time. On the earliest known Manx example the legs are encased in chain armour, without spurs. And thus we have traced the pedigree of the three legs of Man to the primitive solar wheel, the tire being excluded as useless, since the idea of running, yet rotating, was obtained without it. Indeed, the dirty little boys in our streets, when they "turn wheels" before the 'buses, do their best to reproduce the type.

A very curious question now suggests itself: Why three legs only?—and a volume might be written in reply. Well, to begin with, the number has been reduced to the fewest practicable, on that principle of economy already enunciated. You cannot have a wheel with less than three spokes; and less than three legs running, however grouped, would not appear to rotate, yet in all positions stand firmly. Take, for

example, a three-legged stool. .But there is much more than this in the matter. Amongst the most noted symbols of the sun were the horse, the lion, and the cock—the horse for its swiftness, which idea was further intensified by representing it as winged; the lion as suggesting strength, dryness, heat, and for other reasons. A red lion, with the sun behind, is still borne on the standard of the Persians. The cock, that announced the dawn, was specially sacred to the sun. Now, on the oldest gems and coins we frequently meet with this rotating sun-emblem, in which each element is replaced by a winged lion, or a winged horse, or a cock, and *always as a triad* (see figs. 36 and 37). Of course, the explanation already given, founded on the idea of apparent stability, would no longer account in these forms of the emblem for the invariableness of the number. Indeed, the longer one studies the symbols that have survived to our time of these old nature-worships, the more one perceives that even the apparently trivial details in them are full of profound meaning. *Three* is with all of them the most sacred number, and trinities and triads abound. Thus, in the Northern mythology, although Thor, Wodin, and Frea, the three great gods, are usually represented as separate persons with different attributes, sometimes we see instead a single body with the three heads; and again, each of the three gods had three forms cr manifestations. Many attempts have been made to explain this remarkable phenomenon. A primitive revelation of the Christian dogma of the Trinity in unity has hitherto been the most popular. Whatever be its origin, one thing is certain, that the idea was generally diffused over the ancient world long before the advent of Christianity. Let me venture to suggest another possible explanation which, so far as I know, is new. The great parent-languages of old have usually three numbers—the singular, the dual, and the plural. Many of these Pagan peoples were, as St. Paul

testified of the Athenians, "in all things God-fearing, very religious" (κατα παντα δεισιδαιμονεστερους). They strove to represent their God as infinite in his attributes, powers and manifestations, and yet endeavoured to do this by the simplest means. The principle of economy, therefore, suggested the number *three* as being the smallest number that would represent *the indefinite plural*, and therefore express the attributes and manifestations without number of the Godhead. So interesting a topic might well tempt us farther, but we must refrain.

Let us, by way of conclusion, sum up in a few words the results of our enquiry. There is not the slightest trace of the three legs symbol having been employed in connection with the Isle of Man until after the cession of the island to Alexander III of Scotland, in 1266. The only arms or emblem known to have been used before that time was the ship in full sail, the sign of the Norwegian kings; but ever since that period, down to our own day, the three legs running has been the heraldic emblem of the island. It was borrowed by the Scottish king from the Sicilians, of whose island it has been the distinguishing badge for two thousand years, his knowledge of it having been derived from and his attention called to it by the offer of the Sicilian crown to Henry III of England, and afterwards to his son, Prince Edmond, who indeed assumed the title of King of Sicily, and who were respectively Alexander's father and brother by marriage. This heraldic sign was originally a religious emblem of the most sacred character, derived from and always associated with the worship of the sun. It was invented by the ancient Chaldeans or Assyrians, and borrowed from them and humanized by the ancient Greeks who colonised Sicily. Like the "fylfot" or "suastika," it was a modification of the solar wheel by incorporating also the idea of the sun-god as the swift runner, the racer, and was reduced

from four to three elements to form one emblem, yet a sacred, united triad, expressing by the lowest indefinite plural number the innumerable, the inexhaustible attributes of their Supreme God.

NOTE A.—It was contended by some, when this paper was read, that the Isle of Anglesey, not that of Man, was here intended. A word, therefore, may be added in confirmation of the text. Cæsar expressly tells us that he took great pains to obtain accurate information as to the coasts of Britain, both by enquiry from traders and others, and by sending out a special surveying expedition; and the sketch he gives of the geography of Britain is surprisingly accurate for the time. When, therefore, he tells us that the island of Mona lies in the mid seas between Hibernia and Britannia, there can be no mistake; one island alone answers to the description. It is true that, one hundred and fifty years after, Tacitus, who never set foot in Britain, applies the name Mona to the Isle of Anglesey, which is only separated from the mainland by a mere cleft in the coastline, a space that was readily forded by the cavalry of Agricola. But this plainly could not have been the Mona of Cæsar. Again, the Isle of Man alone has always borne the ancient name, *and no other*. From a Runic monument at Kirk Michael it appears that in the twelfth century the Northmen called it *Maun*. Polydore Vergil, writing in 1470, says: "There are manie iles adjacent to Britagne, and two of fame: the one called the Ile of Wight, the other, somewhat famous, is the Ile of Mona or Man."

NOTE B.—Another explanation has recently been offered by Mr. Robert Brown, Jun. (*The Unicorn: a Mythological Investigation*, pp. 66, 67.) After quoting from Planché's *Pursuivant at Arms* the remark:—"The origin of the bearing (the arms of Man) has yet to be discovered," he adds, "Behold it." In few words, Mona or Man signifies,

according to Mr. Brown, the Moon Island, and the Triquetra are simply three crescent moons. An ingenious idea, certainly, which would claim consideration if there was one particle of evidence in its favour, but as there is none, we may dismiss it with the bare mention.

EXPLANATION OF THE ILLUSTRATIONS.

Fig. 1—The Solar disc, usual form in the Egyptian hieroglyphs.

Fig. 2—The Sun-wheel, as a solid disc with axis. This is the form still used to signify the Sun in Astronomy, as it was by the Astrologers.

Fig. 3.—The Sun-wheel with four spokes. This was the form of the sacred cakes used at the Mithraic Banquets.

Fig. 4.—The Sun-wheel with a central axis. This is found on the reverse of early Greek coins, filling the entire field.

Fig. 5.—The Sun-wheel with eight spokes, much less common in ancient art than four.

Fig. 6.—The Sun-snake or Serpent, within a circle, is a sacred emblem frequent in Chinese and Japanese Art. It is an elegant mode of representing a wheel rotating, reduced to the simplest possible elements. See 8 and 14.

Fig. 7.—Here we have the idea of rotation still better given by three spokes, curved to give the idea of direction; a primitive form of the three legs symbol.

Fig. 8.—Origin of the "fylfot" or "suastika," by leaving out part of the rim of the sun-wheel.

Fig. 9.—The spokes only of the sun-wheel forming a cross, often used alone as a solar sign.

Fig. 10.—The Sun-star, a frequent sun sign, developed from 5.

Figs. 11 and 12 are from Babylonian or Assyrian seals, figured by Lajard, *Culte de Mithra*. The sacred Mihr or winged sun in 11, is replaced in 12 by the "Triskele," as fig. 7, shewing their common origin and significance.

Figs. 13 and 14 are from very ancient coins of Lycia, figured by Sir C. Fellows, and exhibit early forms of the "Triskele," still retaining the central axis of the solar-wheel. On No. 13 it appears impressed on the body of the solar-griffin. On No. 14 it is accompanied by the sun-snake, which also retains the axis.

PLATE I.

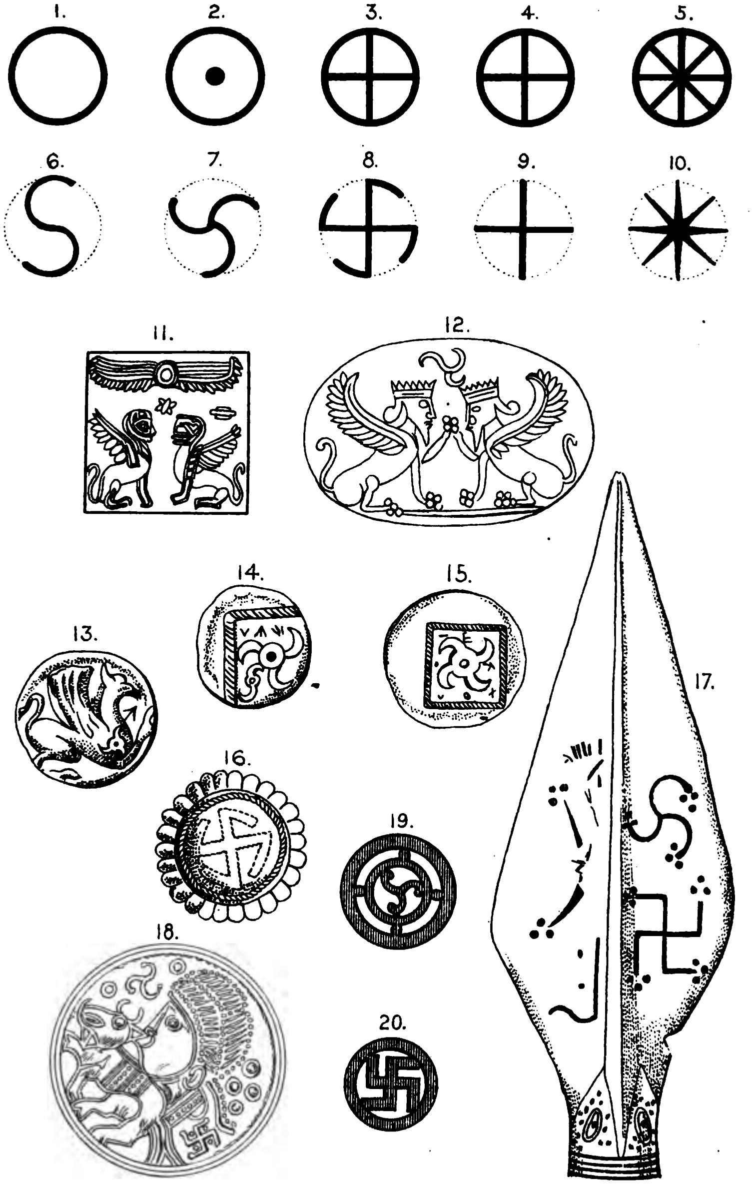
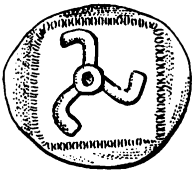


PLATE II.

21.



22.

23.

24.

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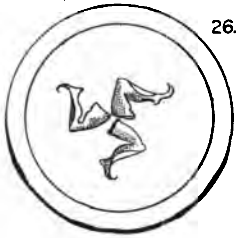

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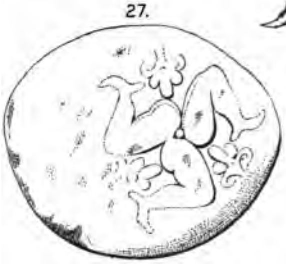

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Figs. 15 and 16 shew well the origin of the "fylfot" from the solar-wheel. The first is from a coin of Lycia (about 500 B.C.), the other is from an Etruscan ear-ring figured by Waring.

Fig. 17.—An Iron Spear-head, from Brandenburg, N. Germany, covered with sacred signs, among which sun-wheels, the "fylfot," and the "Triskele" are conspicuous. Waring.

Fig. 18 is from a gold medal, or bracteate, figured by Worsaae, in his *Ancient Arts of Denmark.* It represents Thor with the he-goat, surrounded by the suastika or fylfot, the triskele, and the cross (formed by four suns) the signs for Thor, Odin and Freya.

Figs. 19 and 20 are Scandinavian ornaments, from Thorsberg, containing the same sacred signs. Worsaae.

Fig 21.—From a very ancient Greek coin of Aspendus; it exhibits well the origin of the triskele from the sun-wheel.

Fig. 22.—From a coin of the ancient Britons, represents the sun-horse with wheel underneath; above is an emblem like the primitive triskele, but with eight curved arms, modified from the eight spoke wheel, fig. 5.

Fig. 23.—Another bracteate, from Worsaae's Work, represents the Scandinavian triad: Thor in the centre, Odin with sun-horse, Freya with sword, surrounded by three cross-signs, and the triskele, which, though primitive in form, gives the idea of running.

Fig. 24.—From an early Greek coin of Caulonia, represents the sun-god, nude, with his four-winged counterpart, running and flying. British Museum.

Fig 25.—A warrior, from an ancient Greek vase, on whose shield is figured a leg running. Waring.

Fig. 26.—Three legs armed with greaves, running in a circle, borne on the shield of a warrior; from a Greek vase found at Agrigentum in Sicily. Waring.

Fig. 27.—From a very ancient Thracian coin, representing three legs running. There are wings to the heels, and three phalli or fleur-de-lis. British Museum.

Fig. 28.—The sun-chariot with the sun-lion running under; from a coin of Syracuse, about 480 B.C. British Museum.

Fig. 29.—The sun-god in his chariot; instead of a human head is the solar-disc, rayed. Roman denarius. British Museum

Fig. 30.—The three legs running, and winged, having for centre the solar-disc, rayed; from a coin of Syracuse, 300 B.C. British Museum.

Fig. 31.—The sun-lion with the triskele, two sun symbols in one; from an archaic coin of Aspendus. British Museum.

Fig. 32.—The sun-horse winged, the three legs running under; from a coin of Syracuse, 300 B.C.

Fig. 33.—The sun-god winged, in his quadriga, or four-horse chariot, having the eight-rayed sun emblem above; from a coin of Syracuse.

Fig. 34.—The same, but the triskele of three legs replaces the eight-rayed sun symbol; from a Syracusan coin. British Museum.

Fig. 35.—The Chimæra, from a coin of Sicyon. British Museum. See page 213.

Fig. 36.—The triple symbol formed by three winged lions, from an Assyrian signet. British Museum.

Fig. 37.—The same, formed by three cocks, with the solar-disc in the centre; from a very ancient coin of Lycia. British Museum.

Fig. 38.—The Mihr, or winged solar-disc, that special emblem of the Divine presence common to the Egyptians, Chaldeans, and Persians, is here represented as a triple triad, three figures, three wings, and the glory or lightning is three-forked, from an Assyrian signet. British Museum.

Fig. 39.—Three flowers on one stem, each a triad; the sacred device on a Jewish shekel of Simon Maccabæus. B C. 139. British Museum.

Fig. 40.—The terminal knobs of an ancient Danish neck-ring, decorated with sacred signs. One bears a triskele with three others inserted, the second has the triskele enclosing three triangles, each made by three dots. From Worsaae.

Fig. 41.—The ship (slightly restored) on the seals of Harald, King of Man, dated A.D. 1245 and 1246. British Museum. From Oswald's *Vestigia*.

Fig. 42.—First appearance of the Three Legs of Man; from seal of a charter, about A D. 1300. British Museum. Oswald's *Vestigia*.

Fig. 43.—The later form. Oswald.

PLATE III.

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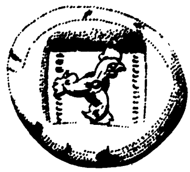

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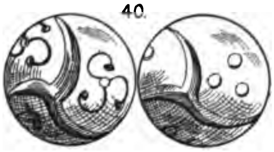

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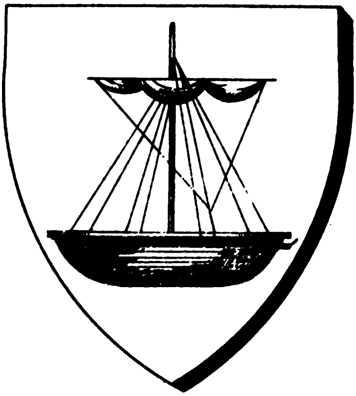

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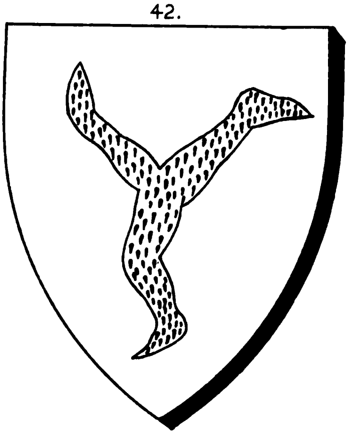

43.

THE FOUR-PENNY SILVER COINAGE OF GREAT BRITAIN ("JOEYS").

By J. BIRKBECK NEVINS, M.D. Lond., M.R.C.S.

The course determined upon by the Government of withdrawing the silver four-penny pieces from circulation, and the difficulty now experienced in obtaining them, furnishes a reason for bringing the subject before the Society at this time.

The present coinage only dates from the reign of William IV, and its origin was curious. The Hackney-Carriage Authority in London decided, in the year 1835, that the fare of a shilling a mile for public carriages plying for hire in the streets was too high, and reduced it to eightpence. Of course the driver never had the requisite fourpence in his pocket for change out of a shilling, and the difficulty arising from this circumstance was one which could not be met by legislation. At that time Mr. Joseph Hume, M.P. (commonly called "Joe Hume"), was an important member of the House of Commons and a great power as an economist, who criticised the Government expenditure with the utmost care and tenacity, and compelled a much more strict observance of economy than was previously practised in public matters. The same feature of character made him careful in private expenditure also; and his soul was exercised by having to pay a shilling when eightpence might have sufficed if the Jehu had but had change. He, therefore, induced the Government to issue a new silver coin, value fourpence, in order to pay the cab fares, and this coin was first issued from the mint in 1836, the last year but one of the reign of William IV. Cabby was highly indignant, and

relieved his feelings by nicknaming the coin a "Joey," by which name it was long universally known in London, and, to a smaller extent, in the provinces.

It was soon discovered that the cabs could not run for eightpence, and fourpence, and the fare returned to its original standard of a shilling, and sixpence; but the issue of the four-penny piece having commenced it was continued, although its special object was at an end, and the issue of a three-penny piece soon afterwards, provided a small convenient silver coin which was a half-sixpence and possessed many advantages that were absent from the four-penny piece. The issue of the three-penny coin is therefore continued, but in 1856 the last four-penny pieces were coined; and as they have now become worn out and a source of confusion rather than of convenience they are called in, and it is with great difficulty that a four-penny coin with a legible inscription upon it can be obtained.

During the endeavours to obtain a collection for exhibition to the Society, I had the opportunity afforded, through the kindness of bank officials, of looking over several thousand which were on their way to the mint to be melted up, and I was struck with the circumstance that, whilst the date of 1841 seemed very scarce, I never saw one with the date of 1847, or of 1850, 1851, 1852, or 1853. Then came good coins of 1854 and 1855, but none of later date. My friends in the banks could not give me any information on the point, and I therefore wrote to Mr. Freemantle at the Royal Mint, who most courteously gave me the following information:—

The coinage being new in 1836 it was a large one, and it was continued year by year as shown in the table below; but *until the year* 1870 *the Mint did not invariably strike a new die for every year if the coinage was small.* This is probably the explanation of no coins being found of the missing dates. It will be seen that in 1841 the coinage was

barely a quarter of the previous issues, in 1847 it was much less still, in 1851 it was only a few hundred pounds, in 1852 there was none, in 1853 the issue was a nominal one only, and in 1856 it was also very small.

Complete Coinage of Four-Penny Pieces ("Joeys").

Reign.	Date.	Value Coined.	
William IV ...	1836	... ... £70,884.	
" ...	1837	Average about £20,000.	
Victoria ...	1838		
" ...	1839		
" ...	1840		
" ...	1841	... ... £5,742.	
" ...	1842	Average about £20,000.	
" ...	1843		
" ...	1844		
" ...	1845		
" ...	1846		
" ...	1847	... ... £3,762. apparently from old die.	
" ...	1848	Average about £20,000.	
" ...	1849		
" ...	1850	... ... £9,900	from old die.
" ...	1851	... ... £521	
" ...	1852	.. .. none	
" ...	1853	... ... £198	
" ...	1854	Average about £20,000.	
" ...	1855		
" ...	1856	... ... £1,584. from old die.	

Previous Coinage of four-penny pieces, "Groats."

It is a curious circumstance that, while the last issue of the four-penny piece came out under a name of ridicule, the first issue appeared under a name of special honour, as the "Groot" or "Great" Coin,—the "Groat"—by which name

it was and is still described from the date of its first issue by Edward III in the early period of his reign.

Previous to the Norman Conquest there was no special English silver coinage, but the silver coins current on the continent were current silver coinage in England also. William the Conqueror, however, issued three small silver coins bearing his portrait, and termed a "Denier" or "Silver Penny," a "Half-Denier" or half-penny, and a "Farthing." The penny is about the size of a modern three-penny piece, and about the thickness of an ordinary visiting card. These small coins sufficed for the necessities of the country until the reign of Edward III, by which time the wealth and foreign commerce of the country had increased so much as to require a coinage of greater value. Edward, therefore, issued a new "Groot," "Great" Coin of the value of four previous pennies, which was termed a "Groat." The nominal value of the coin being four pennies, its real purchasing value was about equal to a modern five-shilling piece, as we find that the day's wages of a skilled carpenter or mason was a groat or under, throughout the greater part of Edward's reign; while the wages of an ordinary rough joiner was less, and a simple bricklayer's was less still.

The weight and purity of the "Groat" have varied from time to time—chiefly from reign to reign but sometimes at different periods of the same reign; and the following table shows these changes and the prices which they have brought according to their purity or perfection.

COINAGE OF "GROATS."

REIGN.	WEIGHT OF COIN.	SELLING PRICE.
Edward III	89 Grains	2/6 to 10/-
"	72 "	
Richard II	72 "	30/- to 57/-

Reign.	Weight of Coin.	Selling Price.
Henry IV	72 Grains	
"	69 "	71/-
Henry V	60 "	57/- and more.
"	48 "	
Henry VI	48 "	8/- to 52/-
Edward IV	60 "	
"	48 "	15/- and more.
Edward V	... ...	64/-
Richard III	48 "	38/- to 72/-
Henry VII	48 "	3/- to 31/-
Henry VIII	48 / $42\frac{1}{2}$ "	4/- to 20/-
"	42 " and debased.	
"	very debased	
"	still more debased ...	
Edward VI	very debased	37/- to 122/-
Mary	32 grains and purity increased	2/6 to 10/-
Philip and Mary ...	32 grains and purity increased	35/-
Elizabeth	32 grains, purity restored to present standard	4/- to 74/-
James I	none coined	
Charles I	31 grains, many issues	very variable.
Cromwell	none issued	
Charles II	a single coinage on coming to the throne; but after this none have been coined, except as "Maundy Money," which is not currency. From this date none were issued for currency until	
William IV	$29\frac{1}{11}$ grains, 2 issues.	
Victoria	$29\frac{1}{11}$ grains, 12 coinages.	

Although no Groats were coined after the reign of

Charles II, they continued to be in circulation so late as the reign of George III, for they are mentioned incidentally so late as the time of Miss Edgeworth's *Parent's Assistant*, in which "Industrious Jim" received a groat for going on some important errand. But about this time the coin which came in as "the Great" one *par excellence*, had fallen into disrepute as being the smallest of English coins. For the proverb was at that time in use, "I don't value it a groat" or "I would not give a groat for the whole lot."

Edward's Gold Coinage.

There was no English Gold Coinage before 1257, when Henry III coined some "Golden Pennies," which were currency at first for 20 silver pennies, and afterwards for 24 silver pennies. But the wealth and requirements of the country were not at that time equal to a coin of such value, and a petition was shortly presented to him to withdraw the coin from circulation, which was done by the mint accepting the golden penny at the price of 19 silver pennies, which was not an unreasonable commission under the circumstances.

Edward III was the first monarch who followed his example, and his "Rose Noble" is a beautiful golden coin for which as much as £170 has been obtained.

Only two of Henry's coins are known, and they were sold at the price of £41 and £140 respectively.

REMARKS ON *ANGRÆCUM SESQUIPEDALE.*

By Professor HERDMAN, D.Sc.

I have brought for exhibition here some preparations in alcohol which I recently made from three flowers of *Angræcum sesquipedale*, which were sent to me for examination by Mr. E. Harvey, Aigburth. This orchid, which is a native of Madagascar, is chiefly remarkable on account of the prolongation of the base of the labellum to form a very long green whip-like nectary. Darwin shewed in 1862 (*Fertilisation of Orchids*, p. 198), that the anatomy of the flower was such that the pollinia could only be removed, and fertilisation effected, by an insect with a proboscis long enough to reach to the end of the nectary, and correspondingly wide at the base. Darwin examined specimens with the nectary as long as 11½ inches, while 10 to 11 inches seems to be the ordinary length. He found that only the last inch and a half or so of the tube contained nectar. This is probably to prevent the attractive fluid being got at and removed by small insects which have the proboscis too small to fertilise the flower.

In *Nature*, for June 12th, 1873 (vol. viii, p. 121), Mr. W. A. Forbes wrote drawing attention to the probability of the existence of very large moths which could fertilise *Angræcum*, suggested that they were probably Sphingidæ, and asked whether any such insects were known from Madagascar. In the following month (*Nature*, vol. viii, p. 223) Dr. Hermann Müller gave an account of a Hawk Moth (*Macrosilia cluentius*), which his brother, Fritz Müller, had recently caught in Brazil, with an enormous proboscis, between ten and eleven inches in length—thus demonstrating that an insect in all probability capable of fertilising the orchid does really exist. So far as I am aware, the moth

which in Madagascar actually effects the fertilisation of *Angræcum sesquipedale* has not yet been discovered.

On receiving the specimen exhibited, from Mr. Harvey, I first of all worked over the anatomy of the flower described by Darwin, and then made a series of sections through the nectary at different points in its length. Two of the flowers had the nectary about ten and ten and a half inches long respectively, while in the third and largest, the nectary measured fully thirteen inches in length.

The nectary is a narrow thick-walled tube, the lumen of which is usually about equal to the thickness of the wall. It tapers downwards to the free end. The wall is formed of a mass of parenchymatous tissue, bounded externally and internally by an epidermis, and traversed by fibro-vascular bundles. The bundles form a circle, rather nearer to the inner than to the outer epidermis. There are usually ten or twelve of them about the middle of the nectary. They are more numerous near the base, and fewer in number near the apex.

Projecting from the inner epidermis into the lumen of the tube may be seen elongated cells of considerable length (0·3 mm.), and with rounded free ends. They are usually filled with granular protoplasm. Sometimes the protoplasm in place of completely filling the cell forms a network enclosing clear vacuoles. The shape and size of these cells vary considerably; some are much elongated with tapering ends, others are shorter and stouter; some are rather club-shaped. Morphologically, they are unicellular hairs; while physiologically, I believe them to be the nectar-secreting organs. Their distribution does not account for the nectar only being found in the lower part of the tube, as they are present throughout the greater part of its length, and certainly scattered over the whole of the wall of the lower half of the nectary.

NOTES ON CORYANTHES MACULATA.

By Professor HERDMAN, D.Sc.

I am indebted to Mr. E. Harvey, Aigburth, for the specimens from which the following notes were taken. The *Coryanthes* flowered in his orchid house, and he most kindly placed two blossoms at my disposal for examination. This genus is one of the most curiously modified of orchids, and the structure of the flower has already been examined and described by Dr. H. Crüger and Mr. Charles Darwin. The additions I am able to make refer only to the microscopic structure.

The flower is pendulous, the morphological base being uppermost (see fig. 1, where PED. shews the peduncle or

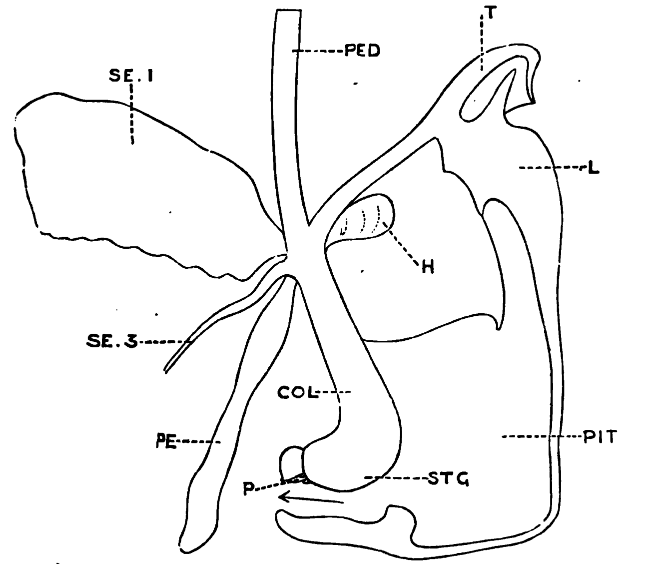

Fig. 1.—Coryanthes maculata var.: vertical section through flower.

Ped., peduncle; se., 1. part of one of the lateral sepals; se., 3, section of median sepal; pe., one of the petals; col., the column; stg., the stigmatic surface; p, pollinia; t, tabular projection from base of l, the labellum; pit., pitcher-like enlargement of the labellum; h, horn. The direction of the arrow shows the course taken by the bees.

stalk). The column (COL.) is large and nearly vertical in position, it bears the stigmatic surface (STG.) and the pollinia (P.) on its down-turned end. The labellum (L.) is greatly enlarged and modified. It consists of a horizontal part which projects from the point where the peduncle joins the column, and a vertical part which runs parallel with the column, and is expanded at its (morphological) upper end into a great pitcher-like structure (fig. 1, PIT.) which has a spout roofed in by the upper end of the column. At the junction of the horizontal and vertical parts of the labellum, a cap-like expansion, the table or plate (fig. 1, T.), is developed; and from the base of the column, where the labellum arises, a blunted spur or horn (H.) projects on each side in such a way that it overhangs the cavity of the pitcher (see figure). These are the more important modifications of this flower (for a more detailed description of the structure of an allied species, *Coryanthes elegantissima*, see an article by Dr. Maxwell Masters, in the *Gardeners' Chronicle* for May 6th, 1882, p. 592).

Crüger and Darwin have shown that *Coryanthes* is visited by bees, and that its curious modifications are for the purpose of attracting the insects to the flower and of causing them to effect its cross-fertilization. The method by which this result is attained is briefly as follows:—The horns or spurs (fig. 1, H.) secrete a watery nectar which drops from their ends into the pitcher below, and partially fills that cavity. The bees come to the table or plate (T.) at the base of the labellum to eat some attractive substance in that neighbourhood, and in struggling for standing room push one another off and fall into the pitcher below. Here they get their wings wet in the nectar and cannot fly out. They are apparently unable to climb up the side walls of the pitcher or the column, and consequently they can make their escape only by creeping along the narrow passage

between the top of the column and the spout of the pitcher (see arrow in fig. 1). In doing this the bee's back comes in contact first with the sticky stigmatic surface, and then with the pollinia. A little of the viscid secretion from the stigma remains on the back, and this catches the pollen masses, detaches them from the flower, and makes them adhere firmly to the insect. The bee then having made its escape, and its wings having dried, flies to another *Coryanthes* flower, where the same process is gone through; but this time when it arrives at the narrow passage it has the pollen masses still sticking to its back, and consequently they press against the upper end of the column, adhere to the sticky surface of the stigma, and are detached and left there, thus effecting cross-fertilization.

When I received the specimens from Mr. Harvey, and had worked over the structure of the flower, I saw that the most interesting parts for a more detailed examination were the minute structure (1) of the nectar-secreting horn, (2) of the plate on which the bees congregate, and (3) of the inner surface of the pitcher. I sectionized these parts of the flower, and examined them, with the following results:—

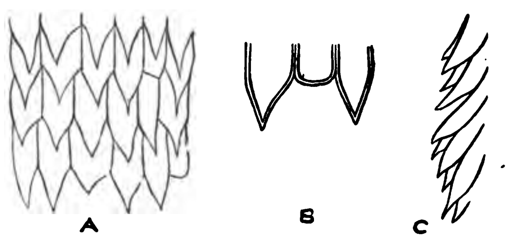

FIG. 2.—EPIDERMAL CELLS FROM THE COLUMN OF CORYANTHES.
A surface view; B, part of A. more highly magnified; C, profile view of scales.

On the surface of the column next the "pitcher," or lip, just above the entrance to the spout-like passage, the epidermal cells are prolonged into tooth-like projections or scales. These are arranged with considerable regularity in an imbri-

cating manner, and all have their points directed downwards, *i.e.*, towards the top of the column where the stigmatic surface is. Figure 2 shows the arrangement of these scales:—A is a surface view, B is a small part of A more highly magnified, while C gives a profile view as seen in a section. This structure looks as if it was intended to prevent bees from climbing up the column instead of creeping through the spout-like passage.

The inside of the bucket-like labellum itself is, so far as I examined it, perfectly smooth, being lined by epidermal cells with flat surfaces.

The "horn," which produces the slightly sweet fluid is somewhat difficult to sectionize on account of its softness and stickiness. First, I examined it fresh and made some sections, then I put the remainder in absolute alcohol for a week, and afterwards made a further examination of it, and took another series of sections. The superficial layer of cells

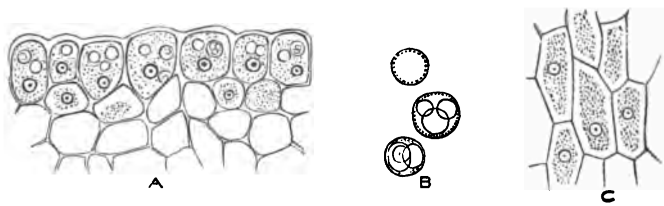

FIG. 3.—CELLS FROM THE "HORN" OF CORYANTHES.
A, vertical section; B, clear spherical bodies from the secretion, highly magnified; C, surface view of nectar-secreting cells.

all over is formed of moderately thick-walled, very protoplasmic cells, with distinct nuclei (fig. 3, A). They are nearly cubical, or in some cases elongated vertically. Fig. 3, C, shows a surface view of these cells. Underneath this layer lies ordinary thin-walled parenchymatous tissue (fig. 3, A). In the sections made from the fresh "horn," the protoplasm of the superficial cells contained a great many spherical clear bodies of various sizes, and these in many

cases contained two or three smaller rounded bodies (see fig. 3, B, which is a highly magnified representation). These were not starch grains; they stained yellow with iodine. They were probably not oil globules, since they were apparently unaffected by the addition of ether and alcohol. The surface of the "horn" when fresh was covered by the slightly sticky secretion, and this showed under the microscope the same rounded clear bodies which were present in the surface cells. The rest of the secretion seemed a watery or slightly viscid fluid which took on a uniform stain with aniline blue or eosine, and showed no structure under a high power of the microscope. In the sections made from the pieces of the "horn" which had been kept for a week in alcohol, the clear rounded bodies were almost entirely absent. This seems to show that they are soluble under the prolonged action of alcohol.

The plate or rounded projection from the base of the labellum is placed above the pitcher in the natural position of the flower. The upper surface, upon which bees would alight, is very decidedly convex. This structure is almost

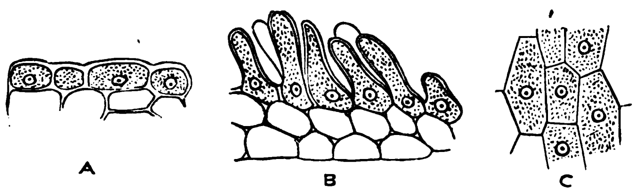

FIG. 4.—CELLS FROM THE PLATE AT THE BASE OF THE LABELLUM OF CORYANTHES. A, vertical section; B, vertical section of another part; C, surface view.

entirely formed of thin walled parenchymatous cells, and as the first series of sections which I made showed nothing else, I was unable to understand why the bees should eat this part of the flower,* and was inclined to think that it might be the sweetish secretion from the "horns," which after all

* See Darwin's *Origin of Species*, 6th ed., p. 154.

attracted them to the plant. Some other sections which I have made since, show, however, that one part of the plate (which part I am unable to say for want of material—the last sections were made from small fragments of the structure) has the surface layer of cells filled with granular protoplasm (fig. 4, A), and in some cases prolonged upwards into long finger-like projections (fig. 4, B). All intermediate conditions between A and B can be found, and in some places the projections are even longer than those shown in B. Fig. 4, C, represents a surface view of A. In all cases these cells are distinctly nucleated, and I have no doubt this is the tissue the bees feed upon, if, as Crüger says, it is the plate-like projection that they eat. On the other hand, the presence of the small clear spherical bodies in the nectar and its slightly sweet taste renders it probable that that secretion has some function beyond merely wetting the wings of the bees, so as to prevent their escape from the pitcher in a way which would not conduce to the cross-fertilization of the plant.

ON THREE BOOKS, PURPORTING TO BE *THE BOOK OF JASHER.*

"*Is it not written in the Book of Jasher.*"—JOSHUA x, 13; 2 SAMUEL i, 18.

BY J. BIRKBECK NEVINS, M.D. LOND.

THE recent revision of the Old and New Testaments has aroused an unusual interest in works relating to them. And the Catalogue of the Liverpool Free Public Library contains two books bearing the above title. One is a thin quarto in English (A 3, Liverpool Library), by an anonymous editor, the other is a thick octavo in Latin (A 1275, Liverpool Library), by Dr. Donaldson, late Fellow Trinity College, Cambridge. The third work is a thin octavo in Hebrew, which is not in the Liverpool Library.

In presenting these works to the Society, it is not necessary to dwell at length upon Dr. Donaldson's volume, the contents of which are known to scholars. It merely professes to be a translation into Latin poetry of the songs which its author has collected from the Old Testament, and accompanied by learned notes. These songs are the account of the Creation and the Temptation in the Garden of Eden, the Songs of Jacob, of Miriam, and of Moses and others, with portions of the patriotic Psalms. These songs, and others still current at the time, were collected, according to different authorities, in the time of Samuel or of Solomon, or by Ezra when he collected and edited the Sacred Books of the Jews, on the return from the Babylonish Captivity. In this way they constituted "the Book of the Jasher," or "of the Worthies," whose deeds were thus commemorated in national and patriotic ballads,

which so often reflect the real spirit of events at the time they occurred, with even more substantial truth than a subsequent prosaic historical account, although they are doubtless coloured and heightened by poetic imagery and would disclaim to be taken for literal narratives to be judged of word by word.

The work, then, by Dr. Donaldson does not profess to be anything but a collection of these songs, to which he gives his own interpretation. He commences with the Creation and Temptation, which he appears to consider to be a mythical poem with a phallic interpretation, and he represents these and the other songs which he has selected as possibly containing the religious marrow of the Holy Scriptures, shewing the nature of uprightness and the victory of the Israelites, and predictions of their future prosperity and blessedness.

The work attributed to Alcuin is of a very different character, and appears to be but little known, as it is difficult, if not impossible, to learn the character of its contents from the works on Biblical literature which are accessible to the general reader. Beyond the proof contained in the fifth volume of Horne's *Introduction to the Study of the Holy Scriptures*, that the work is a fiction, not to call it by a harsher name (without, however, shewing what its contents really are), I have not been able to find anything which satisfies the question, "What is this *Book of Jasher*, and how is its fictitious character established?" That it is fictitious is asserted in general terms in such articles as refer to it, but that it has also at some time excited considerable attention is evident from the high price to which it attained (20s.), although it is only a thin quarto of less than seventy pages, with no charms of type or illustrations to commend it to the reader.

As an account, then, of a curious work but little known,

which at one time attracted notice, and is to be found in our own valuable Public Library (A 3, quarto), the following notice may perhaps not be without interest to the Society at a time when Biblical revision has aroused so much attention.

The account of the Hebrew work will conclude this Paper.

"*The Book of Jasher,*" *translated into English from the Hebrew by Flaccus Albinus Alcuinus, Abbot of Canterbury, who went a pilgrimage into the Holy Land and Persia, where he discovered this volume in the city of Gazna—Bristol: Printed for the Editor by P. Rose,* 20, *Broadmead, Bristol. Sold by Longmans, London, and Richardson, Bristol,* 1829, 4*to* (A 3, Liverpool Library).

The "editor's" introductory Advertisement and Preface abridged by omissions :—

"This book *was discovered by accident* * by a *gentleman* in a journey through the North of England in 1721. *It lay by him* until 1750," when, on a proposition for a Revision of the Bible, he laid it before "a noble Earl," who approved of it and adds: "By a writing on the outside of the MS. it should seem that this translation was laid before our first reformers, for it says: 'I have read *The Book of Jasher* twice over, and I much approve of it as a piece of great antiquity and curiosity; but I cannot assert that it should be made a part of the Canon of Scripture.—Wickliffe.'

"Since 1751 the MS. has been preserved with great care by *a gentleman,* who died some time since. On the event of his death, *a friend to whom he presented* it gave it *to the present editor,* who, conceiving that so valuable a piece of antiquity should not be lost to men of literature and to biblical students, has committed it to the press.

* The italics are by the author of this Paper.

"*The Book of Jasher* is not referred to by the prophets or Jewish chroniclers after the Babylonish Captivity, previous to which period it had been preserved by the kings of Judea. This is a full proof that it was not brought back to Judea. It must then of course have been possessed by the kings of Persia, where it was found by Alcuin, *who was the honour of our own country, and the great ornament of the court of Charlemagne,* who received instruction from him in the sciences, and who, as a reward of his merit, endowed him with three rich Abbacies. Alcuin was present with Charlemagne at the Council of Frankfort, and when he left his court and returned to England he was further promoted to be Abbot of Canterbury. *Alcuin founded the University of Paris in* 800.

"His object in remaining in Gazna for three years was his obtaining this single piece of antiquity, which cost him in wedges of gold at least £500. It could not be brought forward by him to answer any end of a secular nature, as it appears he never made it public beyond the circle of his friends, and when old he left it with his other MSS. to a friend, a priest in Yorkshire. Its preservation from one hand to another for so many centuries is easily accounted for by its intrinsic merits and its extraordinary character.

"It makes no claim to be an inspired work, Jasher declaring that he received his information as to events before his own time from Caleb, his father, and Hezron, his grandfather, and from Azuba, his mother.

"I now come," says the editor, "to its internal evidence, which proves it to be the very genuine production of Jasher. . . . His account of the creation of man is truly sublime, and determines a point of the highest importance, the immortality of the soul and a future state of rewards and punishments. It answers all the learned arguments of Dr. Warburton, proving these great doctrines to have been the

undoubted judgment of the first patriarchs. This doctrine established, all the offices of religion, morality and humanity flow from it—man must be an accountable being, and ordained by his glorious Creator to live for ever."

ALCUIN'S INTRODUCTION then follows (here abridged) :—

"The WORDS OF ALCUIN which are to be read before *The Book of Jasher*:—

"I, Alcuin, was minded to travel into the Holy Land and the province of Persia in search of holy things and to see the wonders of the East, and I took with me Thomas of Malmesbury and John of Huntingdon, who learned with me under able teachers all those languages which the people of the East speak; and though we went as pilgrims, yet we took with us silver and gold and riches.

"When we came to Bristol we went into a ship bound for Rome, where we tarried six months, and learned more perfectly the old Persic language. Here the Pope blessed us, and we went to Naples and Palermo through Sicily, and took Melita on our way. After having visited every part of the Holy Land, particularly Bethlehem, Hebron, Mount Sinai, and the like, we crossed an arm of the Persic Gulph at Bassora, and went in a boat to Bagdad, and from thence by land to Casbim.

"Here an ascetic told us that in Gazna, in the furthest part of Persia, was a MS. wrote in Hebrew of *The Book of Jasher.* We immediately undertook the journey, going by way of Ispahan, and at length arrived at Gazna, when we laid aside our pilgrims' dress, and I hired a house in which we dwelt about three years.

"I soon became acquainted with the Keeper of the City Library, and asked him concerning *The Book of Jasher.* He said he had read of such a MS. in the catalogue, but had never seen it, though he had been Custos for forty-five years; but it was locked up in a chest, and kept among the pieces of antiquity in a separate part of the library. As I lived nigh the Custos I soon became familiar in his family, and one day took the opportunity to tell him I was very much obliged for the civilities he had shewn me, and particularly for the free access he had given me to the library. At the same time I made him a present of a wedge of gold, in value £50, which he readily accepted."

The next time Alcuin went to the library he begged to

see *The Book of Jasher*, so the Custos turned to the catalogue and found the book was in a long room in a chest of Mosaic work, finely wrought, but defaced by time. The key, however, was in the keeping of the City Treasurer; but upon "proper application" the Custos said that Alcuin might *see* the book. Then the Custos introduced him to the Treasurer, who smiled when he heard what Alcuin wanted, and said "he was not then at leisure, but he would consider of it." So the next morning Alcuin sent John of Huntingdon to the treasurer with a wedge of gold of the value of £100, and then the treasurer sent word that he would be at liberty and would meet him at the library at nine o'clock.

The time being come, the treasurer unlocked the chest, and showed Alcuin the book, which was a great scroll above two feet wide and nine feet long, and written in large and beautiful characters. Then he locked the chest and gave the key to the Custos, and said that Alcuin could read the book as often as he wished in the presence of the Custos in the library.

Alcuin found accompanying the book a little scroll entitled, *The Story of the Volume of Jasher*, which said that Jasher was born in Goshen, and was the son of Caleb, whom Moses left as Deputy-General in Egypt while he was in Midian with Jethro; that when Moses returned from Midian Jasher was appointed Verger and carried Moses' and Aaron's rod when they went before Pharaoh; that from his attachment to truth he early received his name of Jasher (upright), and that it was a common saying about him in Israel "Behold the upright man;" that he wrote the book which bears his name, and put it into the chest himself; that his oldest son, Jazer, kept it during his lifetime, and the princes of Judah after his death; that the chest and book were taken from the Jews in the last Babylonish captivity, and that they then fell into the hands of the

Persian monarch, and had been kept in the city of Gazna for several hundred years.

It took Alcuin nineteen days to read the volume through, and then he wished to make a copy of it, and applied to the commonalty of the city for permission to do so; but the treasurer opposed his application. "*Some months* afterwards," says Alcuin, "it came into my mind that we would petition for leave to make an English translation of the book;" and he thereupon sent another petition with another wedge of gold to the *Treasurer*, who sent word in a few days that he had considered the matter, and would take the opinion of the *Recorder* on the subject. Alcuin thereupon sent a copy of his petition with a wedge of gold to the Recorder, and a few days afterwards leave was granted him to translate the book into English in the presence of the Custos, but into no other language whatever.

Accordingly the translation was made as follows:—The Custos had the roll on the table, and Alcuin and his friends read a portion and copied it. Then they each translated it, and the Custos burnt their copy of the Hebrew, and kept their translation. In the course of a year and a half they had translated the whole. The Custos had burnt all their Hebrew copy, and also kept all their translations.

Another petition to the *Court*, accompanied by a "proper application" (amount not specified), resulted in Alcuin and his friends being solemnly sworn that they had taken no other copy, and that they would not let any one take a copy in any place as they returned to England. After this their translation was given up to them, when they resumed their pilgrims' dress and returned to Rome, and showed the book to the Pope, who being now ninety-five years old, cried out when they showed it to him, "I have lived to the days of forgetfulness." They then returned to Bristol, after an absence of seven years.

The sequel of these thousands of miles of travel, years of time, and wedges of gold spent in obtaining this book; after the blessing of the Pope upon it, and Alcuin's public position as Abbot of *Canterbury*, and alleged founder of the University of Paris, was (according to the editor's account) that he never made it public, but left this unique and valuable book "with his other MSS. to *a friend*—a priest in *Yorkshire*"—from whom it was transmitted "from one hand to another for many centuries," until it was discovered "quite by accident" (accident undescribed), and laid before "a distinguished nobleman" (name not given). After which event it was "preserved for its antiquity and curiosity only" until "it fell" into the hands of "the present (anonymous) editor," who had it printed for himself by a provincial printer, and "sold" by Longmans, and by Richardson, a publisher in Bristol.

CONTENTS OF THIS "BOOK OF JASHER."

The book begins with a very brief summary of the events from the creation of the world to the "grievous oppression" of the children of Israel under Pharoah. And "all these things which I, Jasher, have written received I from Caleb my father, and Hezron my father's father, and from Azuba my mother."

After this introduction, Jasher begins to narrate events from his own knowledge, and informs us that during Moses' forty years' sojourn in Midian, Caleb, his father, "*invented the bow*, and taught the children of Jacob to shoot with the bow to prepare themselves for battle;" but on Moses' return Caleb told the Hebrews to trust in Moses; who sent for Aaron to be his spokesman, and for Jasher "that he may bear the rod before us."

After Pharaoh had refused the Hebrews permission to leave Egypt, Caleb called them together and asked them:

"Are the Egyptians to compare with us? Can they bend the bow? Are not they backsliders? Are not they weak? Up, let us take the bow, and to-morrow enter the land of Egypt (from Goshen), and pass through it to the land of our father Jacob; but let no man do hurt unto the Egyptians unless Pharaoh or his servants seek to slay us."

At length Pharaoh consented to let the Hebrews go on condition they left their flocks and herds behind them; but, after some negotiating—(the plagues upon the Egyptians after that of the frogs are entirely omitted from the narrative, and there is not a hint of the plague of darkness or of the deaths of the first-born in Egypt, or the origin of the passover)—Moses proposes to Pharaoh that the Egyptians should buy all their flocks, etc. of the Hebrews, except some brood-stock that "we may have wherewith to purchase necessaries," to which Pharaoh agrees on condition that the *Egyptians* should fix the price. The ready money, however, proved to be insufficient, so "the *Egyptians* said to their wives and daughters give us your jewels, etc., that we may pay the Hebrews that which we owe unto them." So the bargain was completed, and the children of Israel "took their bows" and marched out to the sound of the trumpet.

But the next day, when the Egyptians began to count the cattle, etc., they found they had got short measure, for "the Hebrews have sold us more than they had." Pharaoh therefore followed after them, and when Moses saw this he sent messengers to Pharaoh to say, "Are not the tribes of Israel more in number than the people of Egypt? Let us go and serve the Lord in the wilderness." But "Pharaoh was exceeding wrath," and said they had "deceived him and his people." Moses and Aaron and the elders, therefore, sent Jasher to say that they would see if any of the Hebrews had cheated, and if they found that any had done so, they would restore the price. This pacified Pharaoh, who said he

would wait until the next day, and then, if Moses and the people did not perform their covenant, he would slay them all. "And the people feared greatly, because they had spoiled the Egyptians."

Then Moses told the people that there was only one way of escape—that it was then midnight and that about cock-crow the Red Sea would be dried up, and perhaps they might be able to cross, and before Pharoah would have time to follow them the waters would return and overwhelm them. Which accordingly took place, and the next day after the Hebrews had passed over "Israel saw the Egyptians stay on the banks of the sea." The Egyptians, however, did not relinquish the pursuit, but drove into the Red Sea and were drowned.

Then follows a narrative of how Miriam taught the Hebrews to dig wells, and to cultivate the desert, for "how long we shall dwell therein is not known to man." She encouraged them to shoot wild animals for food, and said that, until the ground had time to produce the necessary crops, the money they had sold their things for in Egypt would enable them to buy all they might want from the people round about them in the desert.

This they did, and cultivated the ground and planted trees, and so forth, until in their journeying they came to Rephidim, where the Amalekites dwelt, and Moses, seeing they were rich in flocks and herds, etc., said, "Up! let us drive them out of the land that we may possess it." But Miriam urged that it was four hundred years since the Hebrews had dwelt in Canaan, and these Amalekites did not know them, and would not regard their claim to the land, so they ought to offer to buy it, and not take it. Jasher was, therefore, sent as an ambassador to negotiate this purchase, but the Amalekites said, "What wrong have we done to the descendants of Jacob? Will they take from me that which

is my own, the land of the Amalekites?" When Jasher returned with this reply, it ended in the fight in which Amalek was destroyed.

Then follows an account of Jethro's visit to Moses; and in addition to the advice he gave Moses about appointing Judges to divide the labour of ruling the people, the appointment of a seventh day of rest especially, and the ten commandments, only somewhat varied in arrangement, are also attributed to him.

But Miriam was very angry, and said, "Shall Jethro instruct the Hebrews? Are the children of Jacob without understanding? Are the customs of the Midianites to be brought in among us? Are we to forsake the good old paths of our fathers, Abraham, Isaac, and Jacob?" And the people were on her side, "And all the days of Miriam the children of Israel did according to the words of Abraham, of Isaac, and of Jacob," but it is not stated how these differed from the commandments which Jethro had urged upon Moses, which appear to have been almost verbatim in accordance with the Sinaitic law, and simply an anticipation of it.

After this follow several chapters saying how *Jethro* dictated the pattern of the altar and of the tabernacle, and how Moses and Joshua, Nadab, Abihu, and Jasher, went up into Mount Sinai to stay there forty days and forty nights, "And I, Jasher, the son of Caleb, bore the rod before Moses and Joshua and the seventy elders of the people."

When, however, they had been three days and nights in the Mount, the people called upon Aaron to take them back to Egypt rather than that they would submit to Moses and the Midianitish laws that Jethro tried to impose upon them. So Aaron sent messengers to Moses and the others in the Mount, who, after having sent the messengers back, agreed among themselves that they would say they had

eaten and drank in the presence of the Lord, and that he had spoken to them. Nadab and Abihu, however, would not agree to this, but returned to the camp. When Moses, Joshua, and the seventy elders came down at the end of forty days, Moses promised the priesthood to Aaron, and having so done, told the Levites to fall upon Nadab and Abihu and kill them and the rest of the people, of whom they therefore slew several thousands, "but Aaron held his peace." Then Moses pronounced to all the people, as the commands of the Lord, the laws which Jethro had previously given to him, and now they were accepted as being divine.

After this, the book narrates nothing deserving of comment until the death of Moses, who took Jasher's rod from him, and laid it up before the ark, where "it remaineth unto this day."

In relating the fall of Jericho, Rahab is introduced as a woman renowned for wisdom, who was called to the councils of the king of Jericho, and advised him to give up the city peacefully, and condition for favourable terms; but her advice was rejected, and the city was destroyed, while she and her family were saved by Joshua.

In the ultimate settlement of the land by Joshua, Jasher represents himself as playing an important part, and says that after Joshua's death, Caleb, his father, was Judge for twelve years, and after his death, Jasher says, the people elected himself to be Judge.

Some time after this, a discussion arose as to what should be done with the remnants of the Canaanites and the other nations. Ehud advised that they should be exterminated, but Jasher advised that the Israelites should make terms with them, and allow them to remain unmolested in certain cities, while the children of Israel should occupy the bulk of the cities and of the land, marriage

between themselves and the nations being, however, strictly forbidden. This advice was adopted, and treaties of peace were agreed to, and "the children of Israel served the Lord all the days of Jasher."

After he had ruled Israel twenty-four years, he wrote his book, and ordered his son Jazer to make an ark into which he put it; and "Jazer laid it up in the city of Jezer."

"The end of *The Book of Jasher*."

WHAT CLAIM TO AUTHENTICITY DOES THIS WORK POSSESS?

None but the audacity of its own assertions. The Jews have no tradition of the original existence or subsequent loss of any book by an individual of the name of "Jasher," and the assumption of such a name shews the work under consideration to be a fiction; for the Hebrew which is translated "the book of Jasher" in the A. V. is really "the book of *the* Jasher," otherwise "the book of the actions of the upright," the "noble," the "worthies." The definite article in Hebrew being never placed before a proper name, the assertion that "I, Jasher, the son of Caleb," did this and that, and that "I heard this from my father," etc., is a proof that he is not "*the* Jasher," the indefinite "upright," "worthies," whose deeds are referred to in "the book of *the* Jasher" in Joshua x, 13, and 2 Samuel i, 18.

On examining the book in detail, it exhibits the proofs of its fictitious character in multiplied places. The story of its discovery and preservation is marked by an absence of everything approaching to probability or calculated to inspire confidence in its genuineness. The whole account in the preface, professing to be from Alcuin himself, involves the confusion of two Alcuins, who were at one time confounded with each other because both had had the title of "Albinus" attached to their name, viz., Alcuin, Abbot of St. Augustine's, Canterbury, and Alcuin of Northumberland, who was not

born until about three years after the death of Alcuin of Canterbury.

Alcuin of Canterbury was born in the seventh century, but the exact date is uncertain. He was made Abbot of St. Augustine's, Canterbury, by Archbishop Theodore, A.D. 710, and communicated to Bede the information relating to the church in that city and in the south of England, and he died about A.D. 732.*

Alcuin of Northumberland—or of York—the friend and teacher of Charlemagne, was born of noble Northumbrian parentage, about A.D. 735, three years *after the death* of the other Alcuin. He was the hereditary representative of the noble house from which St. Willibrod, the apostle of the Frisians, sprang, and as such he ruled, when still young, a small monastery build by his ancestors on a little promontory jutting out of Yorkshire, north of the Humber. He was brought up in Archbishop Egbert's school in York, which was at that time a celebrated school of learning, and here he was taught by and became a favourite pupil of Archbishop Egbert, who was the disciple and friend of Bede.

Alcuin "probably" visited Rome and France on a short visit while still a yonng man in company with Ethelbert, before he (Ethelbert) became Archbishop of York, in A.D. 767. And when Ethelbert retired from the Archbishoprick in A.D. 780, he entrusted the care of his valuable library to Alcuin.

In the year A.D. 767, Alcuin was ordained Deacon, when thirty-two years of age, and between that year and A.D. 780, he visited the Court of Charlemagne on a mission from Ethelbert. He went to Rome in A.D. 780 to obtain the Pallium for Archbishop Eadbald, who succeeded Archbishop Ethelbert. After this Alcuin returned to Charlemagne, in A.D. 782, and remained with him for eight years as a member

* Giles's Translation of Bede's *Ecclesiastical History*, Index, vol. iii, p. 405.

of his household, and in charge also of the Palatine Schools, in reward for which services Charlemagne endowed him with three monasteries. In A.D. 790 he returned to Northumberland, where King Ethelred wished him to remain permanently, but he went back to Charlemagne in A.D. 792, and never returned to England again. He died about A.D. 804. (*Dict. of Christian Biography*, A 3045, Liverpool Library.)

This detailed account of his life, which is borne out by the highest modern authorities, shows that there was no period of three unoccupied years in which his alleged journey and residence in Persia could have taken place, nor is there any hint of his ever having been in Persia in any biography extant. All his known works were in Latin, and they have been collected and published in two folio volumes in Ratisbon, and there is not an allusion among any of the collections to this alleged translation of *The Book of Jasher*. If he had made any such translation into English, as is alleged in his preface, it would have been into the Anglo-Saxon of his own period, of which we have examples in Cædmon's poems, and in the Northumbrian Gospels still extant, and of which a copy is in the Liverpool Library (A 95 and A 120–1–2); but the work under consideration is in modern English, and there is no allusion to the Anglo-Saxon from which it must have been modernised.

The concluding statement in "the editor's" preface that Alcuin "founded the University of Paris in A.D. 800," is a pure fiction. The date of its foundation is not known with accuracy, but according to Hallam (*Literature of Europe*, vol, i, p. 16) "though there are some traces of public instruction in Paris about the *end* of the ninth century, it is not certain that we can assume it to be more ancient. For two hundred years more, indeed, it can only be said that some persons appear to have come to Paris for the purpose of study. The commencement of the famous University, like that of

Oxford, *has no record.* But it owes its first reputation to the sudden spread of what is usually called the scholastic philosophy."

There is an article in the *Encyclopædia Britannica* entitled "Universities," and Paris is treated of in it. But all is vague until the beginning of the twelfth century. In Hadyn's *Dictionary of Dates,* the foundation of the University of Paris is given as A.D. 792—renovated 1,200—but no authority is given.

That the contents of the book and the picture which it gives of various historical personages should differ from those with which we are familiar in the Books of Moses does not of itself prove the book to be fictitious, for an independent narrative written by another author might differ in various respects from Moses and not necessarily be untruthful. But very clear proof of authorship or of authenticity (instead of such multiplied proofs of fiction) would be requisite to establish the truth of a narrative which omits, among other things, such important events as the death of the firstborn in Egypt and the origin of the Passover, the observance of which has been a characteristic fundamental feature in the habits of the nation throughout its whole history for above three thousand years, and forms the foundation of so much in the Christian religion developed from it. So much which has been continually borne in mind at Easter for nearly two thousand years, and is still remembered and observed as if it was an event of the most recent occurrence.

The excuse of independent testimony could not be admitted for the assertion that Caleb "invented the bow" and taught the Hebrews its use, of which the Egyptians were alleged to be ignorant—an assertion contradicted by all the records of ancient Egypt, in which the archers occupy a conspicuous position. It is equally inadmissible in the account which the reputed Jasher gives of his own elevation

to supreme authority among the Hebrews, and the position of judge, in succession to Joshua, which he assigns to his father Caleb. These judgeships find no place in Josephus' account, any more than in the Book of Judges; and the character and prowess of Caleb are so frequently and honourably mentioned in the Biblical narrative that it is incredible that his elevation as judge for twelve years in immediate succession to Joshua should have been left without record, and that it should have been forgotten in the enumeration of the Worthies—Ehud and others—who were still remembered and recorded in the time of Samuel or Ezra, or the historian, whoever it might be, to whom the compilation of the Book of Judges was eventually due.

With what object in view did the Author compose this fictitious "Book of Jasher?"

It is difficult to say whether this work is a pure fraud, or an honest half-sincere fiction, or it was written as a reply to Bishop Warburton's *Divine Legation of Moses*, which is alluded to in "the editor's" preface as being completely demolished by the opening chapters of *The Book of Jasher*.

It was first published in 1751 by Jacob Ilive, a type-founder and compositor in London, who (according to the one friend who professed to be the only person acquainted with the origin of the book) was "not perfectly sound in his mind." Ilive had written a book on Hell which was condemned at the time as unorthodox, and according to this friend he wrote and afterwards set-up this *Book of Jasher* at night after the other men had left off work, assisted, however, in the setting-up and printing off by this friend who is alleged to have furnished this account.* The book was

*For details see Horne's *Introduction to the Holy Scriptures*, vol. v., p. 167, who quotes Mr. Rowe-More's *Dissertation upon English Typographical Founders and Foundries*. 1778, as his authority for this history of the edition of 1751.

issued anonymously, because (as is implied) the publication of a book so calculated to disparage the Mosaic account might have been attended with danger. It was published at 2s. 6d., but when nearly a century afterwards it was republished in Bristol, without acknowledgment, its price was 10s., and eventually rose to 20s.

The following account of Jacob Ilive will not be without interest:—

1768. Died, Jacob Ilive, a printer and typefounder of Aldersgate Street, London. "Ilive," says one Nichols, "who was somewhat disordered in his mind, was author of several treatises on religious and other subjects. He published in 1733 an oration proving the plurality of worlds, that this earth is hell, and that the fire to punish those confined to this world at the day of judgment will be immaterial, written in 1729, spoken at Joiners' Hall, pursuant to the will of his mother. A second pamphlet, called *A Dialogue between a Doctor of the Church of England and Mr. Jacob Ilive, upon the subject of the Oration*, 1733. This strange oration is highly praised in Holwell's third part of *Interesting Events relating to Bengal*. For publishing *Modest Remarks on the late Bishop Sherlock's Sermons*, he was confined in Clerkenwell Bridewell from June 15, 1756, till June 10, 1758, during which period he published *Reasons offered for the Reformation of the House of Correction in Clerkenwell.*" In 1751, Mr. Ilive published a pretended translation of *The Book of Jasher*, said to have been made by Alcuin of Britain.—Timperley's *Encyclopedia of Literary and Typographical Anecdote*, p. 718.

It is difficult to assign an intelligible object for this fiction, for its contents lead to conflicting results. On the one hand, the anonymous "editor," in his Preface, lays great stress upon the important witness which the book bears to the patriarchal belief in the immortality of man, and the moral and religious conclusions which flow from that belief; while on the other hand, the book itself represents Moses in a disparaging light, and omits almost all mention of the miraculous element so abundant in the Mosaic narra-

tive. The assumed "Jasher" makes no mention of the origin or institution of the Passover, so intimately associated with Jewish life throughout its history. He makes no mention of the Manna, or the supply of water from the rock in the wilderness, which occupy such an important position, both in the discourses of our Lord and in St. Paul's epistles. The passage of the Red Sea is apparently resolved into Moses' knowledge and the Egyptian ignorance of the time of low water in the Red Sea. The passage of Jordan and the fall of Jericho are described without any allusion to any extraordinary events accompanying them; and the ultimate settlement of the remnant of the "nations" among the Hebrews is described as a matter of well-considered treaty arrangement between them, which was dependent, not upon simple weariness of fighting and contentment with the possessions that Israel had acquired, but upon downright cowardice and faint-heartedness among the hitherto conquering race.

In his description of Moses' character and conduct, the training of the Hebrews, so far from being due to him in any important degree, had for years been an elaborate preparation by Caleb, who had made them into a nation of skilled warriors, stronger and better armed than the Egyptians, instead of the pusillanimous race which required a forty years' discipline in the desert before they were prepared to face war. Of this warlike and well-instructed people Moses comes to take charge. He countenances, if he does not originate, the fraud upon the Egyptians of selling them false measure in the number of the flocks, etc. It is Miriam, not Moses, who supplies them with water in the wilderness. It is to Jethro, not to "the Lord thy God, which brought thee out of the land of Egypt," that the moral law, and no unimportant part of the ceremonial law, are attributed; and the general impression left upon the mind respecting Moses

is, that he was a scheming, and possibly a clever, leader of the people after they had been trained for him, but that he was anything rather than a man of such commanding character, both as a lawgiver and as a leader, as to have stamped his name and legislation upon an isolated nation, in the first instance, for fifteen hundred years, and since then upon the civilised world, containing its millions of inhabitants, during a period of nearly two thousand years, with an authority which is daily extending still more widely, and is the basis of the entire moral, and much of the civil, law of the whole of the white population of the world.

The history of the second edition of this fabricated *Book of Jasher* is involved in uncertainty. It was first published in 1751, and a copy of the edition is in the British Museum. It was *republished* by Richardson of Bristol, and Longmans of London, in 1829, but without acknowledgment or any reference to the first edition. No representative of the Bristol house can now be found, and no representative of the firm of Longmans has any knowledge of the book, beyond an "impression" that it was a *jeu d'esprit;* but no member of the firm at the time of its publication is now alive. It was *printed* by Mr. Rose, of Bristol; and a *grandson* of the original printer, who was a mere boy at the time, just remembers that a parson, in a shovel hat and knee breeches, used to come to the printing-office about it; but he has no recollection of having ever heard the name of the parson or his residence. Archdeacon Norris, one of the canons residentiary of Bristol, informs me that there is no copy or record of the book or its original in the Cathedral Library. But, unfortunately, the valuable Cathedral Library in Bristol was almost totally destroyed in the incendiary fires which were kindled in the city at the time of the Reform Bill agitation of 1830.

So far, therefore, there is no history of any such ancient

MS. being in existence; but the statement in Alcuin's alleged preface (perhaps inserted to impart an air of truth) that he and his companions returned to *Bristol* from Rome is not at variance with evidences of the intercourse between those two cities at an ancient date; for the Archdeacon says in his letter, that Roman coins are not unfrequently dredged up from the mud in the Avon at Bristol, and on one occasion two pigs of lead were dredged up, having the stamp of a Roman inscription upon them, similar apparently in its purpose to the stamp upon tin at the present time from the Stannary Court in Cornwall, as a proof of the quality of the metal.

The Extant Hebrew Book of Jasher.

The third work in Hebrew is still extant, called now *The Book of the Jasher*, or originally, *The Book of the Generation of Man.* It is reported to have been found in the possession of an aged Jew at the time of the destruction of Jerusalem. The Roman officer who took him prisoner, and took the Roll along with him, is reported to have treated him kindly and housed him honourably in Seville after his return from Jerusalem, and the book professes to take its origin from this Roll. It consists of narrative chiefly, and relates only to the period anterior and up to the time of the Judges. It does not profess to be *The Book of Jasher* referred to in Joshua and Samuel; but to be simply the doings of "worthies." It is mainly occupied with events related in Genesis, Exodus and Numbers, and contains little more than a single chapter of the Laws from Leviticus, and barely alludes to Deuteronomy, which, as its name implies, is chiefly a repetition of what has been already related. It contains but a very small portion of Joshua. This Book bears no resemblance whatever to the fictitious work described in this paper, and it is held in so much esteem by some Jews as to have been

translated into Greek, Latin, Syriac, and other Oriental languages; and it is even said to have been presented by the Jews of Syria to Ptolemy Philadelphus.*

The above claim to antiquity and honour is, however, by no means universally conceded to this book, and the following account of its reputed modern origin has been kindly supplied by Mr. Baron L. Benas, whose acquaintance with Jewish literature is well known:—

"The later *Book of Jasher* was composed in Provence about the middle of the thirteenth century. The author is unknown, but it is attributed to a Provencal Jewish author Zerackia Crispia, or possibly Joseph Esobi, of Vaison, near Avignon, about the year 1250. This was the centre of a Franco-Jewish School of poetry and literature. The book, however, does not occupy a high place in the estimation of Hebrew scholars. It is a kind of epic from the birth of mankind (Adam) until the period of the Judges, but there are evident plagiarisms from the Agada, and even from the Koran. It is only successful as a well accomplished imitation of the Hebrew Biblical phraseology. The earliest printed copies, I believe, were issued from the Venetian Hebrew publishers early in the sixteenth century. The book, however, has no historical value, not even as folk-lore."

Usual Titles of the "Book of Jasher."

The English Authorised Version is almost the only Bible which has translated the Hebrew original into "Book of Jasher," with a capital letter, and the ordinary appearance of a proper name. This translation is still retained in the new *revised* version, but "or the upright" is given as a marginal rendering.

Wycliffe renders it (A 14, Liverpool Library, earlier version) "in the book of Rigtwise Men;" (later version) "just men." (Josh. and Saml.)

* Rabbi Stern, the theological head of the Jewish Training College, Portsmouth.

The SEPTUAGINT renders it βιβλιον του ευθους—the book of the "straightforward" (Liddell & Scott, 7th edition).

The PESHITO SYRIAC: "The book of songs."

The GERMAN (translated from the Hebrew): "Buch des Frommen"—"pious, devout, godly" (Josh.); "Buch der Redlichen"—"sincere, upright, blameless" (Sam.).

ITALIAN (Diodatí's—from Heb.): "Libro del diritto"—"book of the just," "true," "sincere" (Josh. and Sam.).

DUTCH (from Heb.): "In het boek des opregten"—"upright," "just" (Josh. and Sam.).

DANISH (from Luther's): "ì den Oprigtiges Bog"—"sincere, candid" (Josh. and Sam.).

ICELANDIC: "ì bók hins rèttláta"—"righteous, just" (Josh.); "ì bók hins hreins-kilna"—"sincere, upright" (Sam.).

WELSH (A. V. from Heb.): "Llyfr yr uniawn"—"book of the upright" (Josh.); "Llyfr Jazer," (margin "upright") (Sam.).

VULGATE (from Heb.): "Liber justorum"—"of the just" (Josh. and Sam.).

SPANISH (from Vulgate): "Libro de los justos" (Josh. and Sam.).

FRENCH (Ostervald's): "Livre du juste" (Josh.); "livre du Jascar" (Sam.).

The Targums, St. Jerome, and eminent Jewish Rabbis have variously assigned the title "Book of Jasher" to "the Book of the Law" to Deut. vi, 18, and xxxiii, 7, because of the allusion to skill in archery; to Judges; to Genesis, recording the great deeds of Abraham, Isaac, and Jacob; and to Samuel, from his account of Gad and Nathan.

ON THE ROCKY MOUNTAIN GOAT.

By THOMAS J. MOORE.

WITH NOTES BY MR. ST. GEORGE LITTLEDALE, ON SPECIMENS SHOT BY HIM FOR THE LIVERPOOL FREE PUBLIC MUSEUM.

I. By Thomas J. Moore.

My object this evening is to bring before the Society a few notes on an addition of considerable importance and value made to the Free Museum by Mr. St. George Littledale, of Liverpool. For years past Mr. Littledale has contributed most liberally to the collections on his return from his shooting expeditions among the big game of India and the Far West of America. Skins and skulls of the Argali or *Ovis Ammon*, the most gigantic sheep of the Himalayas; specimens of the Burrhel Sheep; the Himalayan Ibex; the Caribou and the Prong-horn Antelope, etc., testify to the zealous interest he has taken in adding to the Museum collection.

The two great prizes to the sportsman in the Far West are the Big-horn Sheep and the Rocky Mountain Goat. The Big-horn is the American counterpart of the Argali or *Ovis Ammon* of the Himalayas, but the Rocky Mountain Goat is unique.

It has, therefore, been a great desideratum for the Museum, and my requests for Mr. Littledale's good offices were frequent and pressing.

One hopeful expedition of Mr. Littledale's was abruptly terminated by a dangerous wound in the leg from a hunting knife. The next expedition was happily crowned with

success, and in addition to the gift of two fine adult male specimens, Mr. Littledale has kindly favoured us with some graphic notes relating to them, which are appended to this paper.

The region in which the species is found is so remote that but little is recorded of it. The earliest and best summary is given in the *Fauna Boreali-Americana; or the Zoology of the Northern parts of British America, containing descriptions of the objects of Natural History collected on the late Northern Land Expeditions, under the command of Captain Sir John Franklin, R.N., by John Richardson, M.D., F.R.S., etc., Surgeon and Naturalist to the Expedition.* This was published in 1829; and but little additional knowledge has been since obtained.

The Rocky Mountain Goat has been supposed to be an inhabitant of California, where it is said to have been discovered by Fathers Piccolo and De Salvatierra, who established the first mission there in 1697.

Vancouver brought home a mutilated skin, which he obtained on the North West Coast of America; and Lieut.-General Davies presented a specimen to the Linnean Society, of which an account was published by M. De Blainville in 1816, who was the first naturalist who described it, and he gave it the name of *Antilope Americana;* other descriptions and names followed.

The animal has been known to the traders of the North-West and Hudson's Bay Companies from the first establishment of their trading posts on the banks of the Columbia River and in New Caledonia. A specimen was sent some sixty years since to the Wernerian Society of Edinburgh, and was submitted to a competent judge. He reported that "the wool, which forms the chief covering of the skin, is of the very finest quality," and a suggestion was made to the Highland Society on the advantage likely to

accrue from the introduction into Scotland of an animal bearing so valuable a fleece.

Nothing, however, came of this proposal, and though imperfect skins may have been imported in the way of trade, museum specimens were limited to two or three examples.

Professor Baird, in his exhaustive work on the *Mammals of North America*, 1879, adds but little to the account given by Richardson fifty years before, except that he believes that the creature "is in all its essential features and affinities a true antelope, having little in common with animals of the type of the domestic goat beyond what belongs to all ruminants of its family. The jet black and polished slender conical horns are much like those of the Chamois."

This opinion receives additional weight from the fact first mentioned to me by Mr. E. Gerrard, Jun., and subsequently mentioned by Mr. Littledale in his notes, that there is a considerable naked glandular space behind each horn; and "a cutaneous gland-pit" is noted by Owen as occurring "behind the base of the ear" in the Chamois.

Baird, unfortunately, had no perfect specimen to examine; all the material at his command consisted of four skins, dressed as robes, and without head or limbs; these were all from the Cascade Mountains. This is certainly confirmatory of a statement once made to me that Audubon had to send to London for a drawing of one of the specimens there before he could complete his large work on the *Viviparous Quadrupeds of North America* by himself and Dr. Bachman, as a companion to his grand unrivalled work on the *Birds of America*.

Mr. J. Keast Lord, Naturalist to the British North American Boundary Expedition, in his book entitled *The Naturalist in Vancouver Island and British Columbia*, 1866, writes as follows:—"The Mountain Goat, which is in reality nearer an antelope (*Aplocerus montanus*, Grd.), is a most

conspicuous feature amidst this rocky desolation. Gazing on some unusually splintered and contorted hillside, suddenly a small herd of mountain-goats come, as if by magic, round a jutting corner, and deliberately march along on a ledge where, to all appearance, a cat would be puzzled to find a firm foothold; frighten them and they gallop with equal safety, and, springing from one side of a chasm to another, pitch like a bird, rather than a hard-hoofed four-footed beast, on the narrowest ledges. The females had kids (or fawns perhaps is more correct) by their sides. I ate some of the flesh, but its flavour was goaty in the extreme." Lord and other writers state that the Big-horn Sheep does not frequent nearly such high and inaccessible altitudes as the Rocky Mountain Goat.

II. By St. George Littledale.

A Missionary, who lived in Alaska trying to convert the Indians, told us we should be able to get the White Goat if we went up there, and as I have always been anxious to get that animal, we started in an American steamer from British Columbia. At a small mining camp where the steamer stopped, eight or nine days after leaving Victoria, we engaged a crew of "Hoonah" Indians and a canoe, 45 feet long and 6 feet beam, made by the "Hydah" Indians out of a single tree. They expand the canoe by filling it with water in which they place red-hot stones, making the water boil, and then wedging the canoe apart to give it greater beam. The canoes are beautiful models, and sail very fast with the wind free. We took the canoe and Indians on board the steamer, and the captain dropped us overboard a couple of days afterwards. We had a seven days' paddle to reach the place where I heard the goats were most numerous. We camped at night on the beach above high-water mark. The moun-

tains come down so abruptly into the sea that we had great difficulty many times in finding a place to pitch the tent. We lived almost entirely upon salmon, of which there were countless numbers. We caught them with our hands, by simply wading into the stream, and felt them knocking against our legs. The salmon varied from five up to twenty pounds, but seven or eight pounds was the common weight. We saw great quantities of whales and seals, but comparatively few birds, two kinds of eagle being most numerous.

The climate is a dreadfully wet one; rain nearly every day, caused, I believe, by the warm Japan current striking the cold snow mountains. There is a heavy fall in winter, and in consequence the glaciers are on a gigantic scale. We saw one which is supposed to be sixteen miles across. Many of them come right down into the sea, and end in a solid wall of ice several hundred feet high. I measured one with my clinometer and made it upwards of two hundred. About two hundred yards from the foot of the glaciers there was no bottom at seventy fathoms, and that was as near as we dare go on account of the huge masses of ice which are constantly breaking off and floating away as icebergs. Blocks fall from them, or they split in two and capsize, causing a swell which would be dangerous to a canoe if too close. The coasts of British Columbia and Alaska, up to the fair weather range, are completely land-locked by islands, so that canoes can in ordinary weather go almost anywhere. When the Indians were told that I came to get goats, they laughed, and said only Indians could climb the rocks where they lived, and that no white man ever had or ever would shoot one. When I promised them two dollars for every goat I shot, they replied they would rather have ten cents a day extra wages than ten dollars for every goat I killed.

The country is extremely mountainous, and where I was shooting it was timbered the first 1,500 feet with a thick underbrush of moss, knee deep in many places, which made climbing unusually laborious. There were glaciers in every ravine of any size. I only found the goats on the highest and most inaccessible peaks; the rocks were slate, and the strata ran up and down; the result was tremendous cliffs and sharp ridges, which made many a hard climb end in disappointment.

I never saw more than five males together at once, and never more than three females, which I attributed to the scantiness of the grass, of which there are only tufts here and there, and so if too many got together there would be a scarcity. I never saw a female with more than one young one; but I did not see enough to be sure they never had more than one. They seem to be fairly numerous, but, owing to their white skins, they were very conspicuous, and so I saw all that were there; whereas, had they been sheep, with their neutral coloured hair, probably half of them would be overlooked. They are wonderful climbers; they got down some rocks where, even with the help of a rope, we were unable to follow. They are extremely wary, almost invariably choosing some high commanding rock on which to lie down in the middle of the day, and when there never staying in one position long. They seemed to be always restless and on the lookout, and this was at a place where they had hardly ever been hunted before. The Indians told us that the goats were only found upon the mainland and not upon the islands, but we afterwards saw several lots of goats on an island which was only about a quarter of a mile from the mainland. They also told us that deer were much more numerous on the island, as the wolves did not trouble them there. The Indians make the horns of sheep and goats into spoons; they also weave the hair and wool of the goats into

blankets, which are covered with grotesque faces.* Did you notice the gland, or bare space about the size of a florin, that they have behind each horn; at least, I suppose it is a gland?

WICK HILL HOUSE, BRACKNELL,
November 25th, 1884.

* Specimens were kindly lent by Mr. Littledale for exhibition at the Meeting.—T. J. M.

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